Proceedings of
UNESCO Chair Programme on
Cultural Heritage and
Risk Management,

INTERNATIONAL TRAINING COURSE (ITC) on DISASTER RISK MANAGEMENT of CULTURAL HERITAGE Ritsumeikan University

2014, 9th year
From 6th to 22nd September 2014,
In Kyoto, Kobe and Minami Sanriku-Cho,
Japan

Organized by Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University (R-DMUCH), Kyoto, Japan In Cooperation with UNESCO World Heritage Centre, ICCROM, ICOMOS / ICORP
Supported by Toyota Foundation “Initiative Program”

Five stories pagoda in Hokan-ji Temple located Buffer Zone of KIyomizu-Dera World Heritage Site have special sprinkler system.
If fire occur in the wooden town surround the pagoda,
this drencher system can prevent the fire spread to the cultural heritage.

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Preface

Cultural heritage is confronted with various kinds of disaster risks, due to natural hazards such as floods, fires, earthquakes etc. as well as human induced events such as terrorism, vandalism, armed conflict and arson. As a result, many cultural heritage sites including those on the World Heritage List have been significantly damaged in the recent years. Examples include historic castle of Ferrara in Northern Italy and largest adobe citadel of Bam in the Islamic Republic of Iran due to the earthquakes in 2011 and 2003 respectively, the Old Town of Edinburgh (United Kingdom) due to fire in 2002, ancient city of Ayuthhaya in Thailand due to 2011 floods, Bamiyan Buddhas in Afghanistan and Aleppo Citadel in Syria due to armed conflict in 2001 and 2013 respectively.

Recent research on geological risks conducted by the World Heritage Centre research, based on open-access risk data, has revealed that 76 per cent of all World Heritage properties would potentially be exposed to at least one of five main geological natural hazards (earthquake, tsunami, landslide, volcanic eruption or severe erosion).

Despite the increasing vulnerability of cultural heritage to hazards, disaster risk reduction unfortunately does not register as a priority area for management. This is supported by the fact that only handful of World Heritage Properties have formulated disaster risk management plans and even fewer and implemented them. Among other factors, this is result of low levels of awareness among various stakeholders and the public and the limited capacity building of those in charge of protection and management.

Therefore it is important to conduct site-based risk assessments and, where appropriate, develop the necessary disaster risk management plans outlining mitigation, emergency preparedness, response and recovery measures for various hazards to which the properties are exposed. On the other hand, measures must be taken to advance heritage concerns in the wider agenda for disaster risk reduction and to raise awareness among heritage managers and professionals.

This necessitates building the capacity of heritage managers, civic defence/emergency response agencies as well as decision makers from heritage as well as disaster management fields on reducing disaster risks to cultural heritage. In this direction, a pioneering initiative has been undertaken by the UNESCO Chair established within the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University, Kyoto (Japan), which in cooperation with ICCROM, ICOMOS-ICORP and the UNESCO World Heritage Centre has been organizing international training course on disaster risk management of cultural heritage every year since 2006. The target groups for this course include government institutions, departments, universities, NGOs and private consultants from cultural heritage, as well as relevant disaster management fields. The importance of this training course has been globally recognized as seen with increasing number of applicants from all over the world and our institute hopes to continue this initiative in the future.

Rohit JIGYASU
Professor, Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University, Kyoto
Coordinator of the ITC2014 as a UNESCO Chair Holder

Preface

The Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University (R-DMUCH) was established as a permanent research institution in 2013 and has handed over activities from former organization started from 2003.

The UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage started from 2006 as one of our important educational activities, and fortunately we can continue it up to 9th year supported by UNESCO, ICCROM and many national and international organizations. I would like to thank these colleagues for supporting us and participants from all over the world. The purposes of this training course are education of experts in each field of cultural heritage conservation and disaster risk management, and development of base plan for disaster risk management to secure the safety of people and cultural value in each cultural heritage site and historical city. I hope these plans to be actual projects in each country and contribute to cultural advancement in the world.

Thank you all again and please keep in touch with us for inheriting cultural heritages for next generation.

Takeyuki OKUBO
Director, R-DMUCH
Professor, Department of Civil Engineering, Ritsumeikan University

Preface

The International Training Course is the first attempt at the international level to provide high level education opportunities on the topic natural disasters for people in the cultural heritage field and on the topic of cultural heritage for people in the natural disaster field. In the 9 years that the course has been implemented, we had 556 applicants from 51 countries and 84 people from 14 countries have been trained. The accepted number of trainee is only 12.1% and it is small percentage. Particularly in 2012, we could receive 9 people as trainee among 175 applicants and this is only 5%.

We, therefore, have been proposed to increase the number of trainee from past applicants and people of relevant fields, both of domestic and international communities. The course, however, is financially supported by COE program and the budget of the training course is not large enough to accept all the applicants because the course is one of the projects of COE program.

Recognizing our activities and achievements for ITC, the Toyota Foundation has decided to support the course. Then the total budget has been almost doubled and the number of trainee of 2014 was increased to 14 from 7-10 of previous years. Moreover we could increase speakers not only from domestic but also abroad. On the other hand, we have been proposed to establish a follow-up program from the graduates of our course and people of relevant fields, which is to establish a similar course to our training course in their counties and communities. Owing to the increase of budget by the Initiative Program of the Toyota Foundation, the follow-up program has been implemented in October 2014 in Republic of the Union of Myanmar where our resource persons were dispatched.

In this way, because of the support by the Toyota Foundation, the future of our training course is promising in number and quality, both of trainee and human resources. Hereby we appreciate the recognition and evaluation of activities of our training course by the Toyota Foundation and we would like to express our heart-full gratitude to the foundation.

Kenzo TOKI
Representative, Toyota Foundation “Initiative Program”, Enhancement of the UNESCO Chair International Training Course on Cultural Heritage and Risk Management and Post-training Follow-up
Professor, Ritsumeikan University

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1 Introduction

1.1 Background and Objectives of The 9th International Training Course 2014

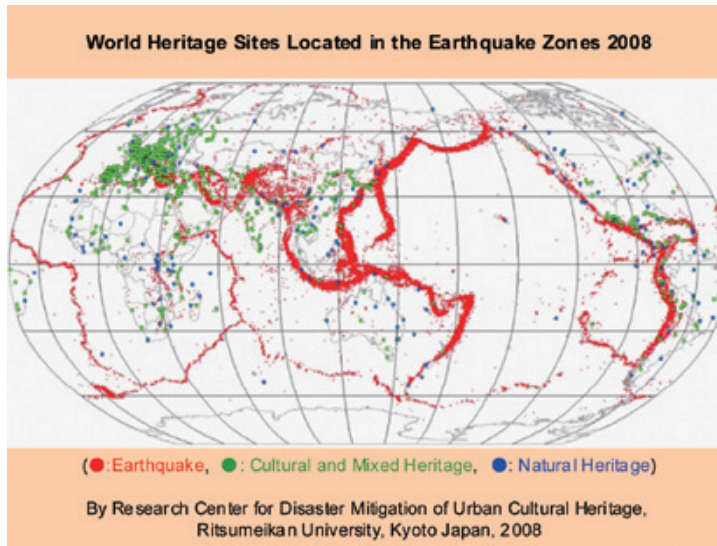
Disasters and Cultural Heritage

Recent disasters such as fires in Lijiang, China in 2013 and earlier this year, destructive earthquake and cyclones in Philippines last year, the devastating tsunami in North East of Japan in 2011 and as well as earthquakes that hit Christchurch, Newzealand (2010 and 2011), Haiti and Chile (in 2010) have caused enormous loss of life, property and cultural heritage. This disaster has once again shown that cultural heritage is highly vulnerable to natural disasters such as earthquake, the Tsunami, fire, floods and cyclones.

Therefore it is important to undertake proactive measures that can reduce risks to cultural heritage from these catastrophic events through adequate mitigation and preparedness. In the post disaster phase, the challenge is how to salvage heritage properties, which are at risk of demolition and to assess their damage. The long term challenge during recovery phase is how to repair and retrofit them and undertake reconstruction that respects tangible as well as intangible heritage values.

In the light of these challenges, comprehensive risk management is essential for the protection of cultural heritage from disasters. Therefore Cultural Heritage and Risk Management project of Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University (R-DMUCH) aims to organize the UNESCO Chair International Training Programme to build the institutional capacity needed to formulate comprehensive risk management plans that are based on the characteristics of cultural heritage and nature of hazards in the regional context.

One of the main reasons for extensive damage to cultural heritage is due to fires resulting from natural or human induced causes. Also fires can result from earthquakes as was the case during 1995 Great Hanshin Awaji earthquake in Japan. Considering these issues, the 9th UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage will specifically focus on **'Protecting living cultural heritage from disaster risks due to fire'.**



Regional Distribution of World Heritage sites located on the Earthquake Zones

Region	0-100 km	100-200 km	Within 200km		Over 200km		Total
Cultural/Mix	100	91	191	27%	513	73%	704
Australia/New Zealand		1	1	14%	6	86%	7
Caribbean	2	3	5	45%	6	55%	11
Central America	10	10	20	59%	14	41%	34
Central Asia	2		2	22%	7	78%	9
Eastern Africa	2	1	3	14%	18	86%	21
Eastern Asia	10	11	21	42%	29	58%	50
Eastern Europe		1	1	2%	56	98%	57
European Russia			0	0%	14	100%	14
Melanesia	1	1	2	100%		0%	2
Middle Africa		1	1	100%		0%	1
Northern Africa	3	4	7	21%	27	79%	34
Northern America	1		1	7%	13	93%	14
Northern Europe	1		1	2%	49	98%	50
South America	8	16	24	57%	18	43%	42
Southeastern Asia	6	1	7	39%	11	61%	18
Southern Africa			0	0%	7	100%	7
Southern Asia	6	8	14	29%	34	71%	48
Southern Europe	35	23	58	45%	70	55%	128
Western Africa			0	0%	16	100%	16
Western Asia	13	8	21	40%	31	60%	52
Western Europe		2	2	2%	87	98%	89
Natural	36	18	54	31%	120	69%	174
Total	136	109	245	28%	633	72%	878

Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University and Its Training Course

UNESCO Chair Programme on the International Training Course on Disaster Risk Management of Cultural Heritage is a follow-up of the recommendations adopted at the Special Thematic Session on Risk Management for Cultural Heritage held at UN-WCDR (World Conference on Disaster Reduction) in January 2005 in Kobe, Hyogo, Japan. One of these recommendations advocated the need for the academic community to develop scientific research, education and training programs incorporating cultural heritage in both its tangible and intangible manifestations, into risk management and disaster recovery. The importance of strengthening knowledge, innovation and education to build a culture of disaster prevention at WH properties was reiterated also by the World Heritage Committee at its 30th session (Vilnius, Lithuania, July 2006).

Furthermore, the “Declaration”, adopted at the International Disaster Reduction Conference (IDRC) of Davos (August 2006) confirmed that “concern for heritage, both tangible and intangible, should be incorporated into disaster risk reduction strategies and plans, which are strengthened through attention to cultural attributes and traditional knowledge.”

In response to these recommendations by the international community, the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH) has been acting as

a focal point for organizing international research, training and information network in the field of cultural heritage risk management and disaster mitigation. Besides R-DMUCH has also functioned as the international secretariat for ICOMOS-International Scientific Committee on Risk Preparedness (ICORP) and many of its faculty are expert members of the Scientific Committee.

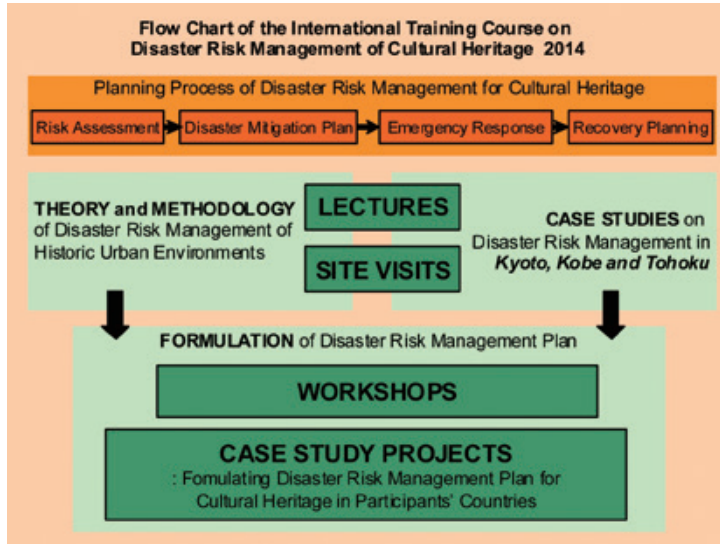
The past training courses has been participated by 84 participants in total from 39 countries; Indonesia, South Korea, China, Philippines, Malaysia, Myanmar and Thailand from East Asia; India, Pakistan, Bangladesh, Nepal, Bhutan, Sri Lanka and Maldives from South Asia; Palau, Fiji, New Zealand and Australia from Oceania; Peru, Jamaica, Colombia, Mexico, Ecuador and Honduras from Central and South America; Serbia, Moldova, Italy, Albania and Croatia from Europe; Iran, Turkey, Afghanistan, Syria and Iraq from Middle East; Kenya, Uganda, Nigeria, Tanzania and Egypt from Africa.

Objectives and Methodology of the Training Course

The main objective of the course was to provide an overview of the various aspects of disaster risk management of cultural heritage. In particular, the course provides interdisciplinary training to:

- ✓ Undertake an integrated risk assessment by analyzing the vulnerability of cultural heritage to disasters caused by natural and human induced hazards;
- ✓ Build an integrated system for disaster risk management of cultural heritage, incorporating prevention/mitigation, preparedness, response and recovery measures;
- ✓ Formulate disaster risk management plans for cultural heritage that correspond to the urban and regional disaster management plans and policies; and
- ✓ Establish an international scientific support network for risk management of cultural heritage in order to build the institutional capacity needed to formulate comprehensive risk management plans that are based on the characteristics of cultural heritage and nature of hazards in the regional context.

The course comprised lectures, site visits, workshops, discussions, team projects and individual/group presentations. Participants were expected to actively participate throughout the course. The course aimd at promoting the development of collaborations and network building among scholars and professionals in cultural heritage protection. This course was provided scientific support by the World Heritage Centre (UNESCO) and the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM)..



Based on the information obtained from lectures and site visits, and exercises through workshops, the training course also set the goal of raising planning skills in cultural heritage disaster prevention, by having each participant make a plan during a team project for the prevention of disaster to his/her country's cultural heritage, in line with each country's respective social and economic situation. In order to do so, the Institute asked the participants to prepare the relevant materials before coming to Japan, so that the two participants from each country could learn from each other's experience through this process.

Special Theme of 2014 International Training Programme:

One of the main reasons for extensive damage to cultural heritage is due to fires resulting from natural (bush/forest fires) or human induced causes (arson, chemical or bomb explosion, poor electric wiring or during renovation works). Also fires can result from earthquakes as was the case during 1995 Great Hanshin Awaji earthquake in Japan. Considering these issues, the 9th UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage focused on **'Protecting living cultural heritage from disaster risks due to fire'.** Policies and planning measures for reducing fire risks to cultural heritage especially in rapidly urbanizing context of developing countries, special techniques for fire prevention and mitigation, emergency response as well as interventions for long term restoration and rehabilitation of cultural heritage following disaster were discussed during the course.

Previous International Training Courses (2006-2013)

ITC 2006

In 2006, which was the first year for this course, eight participants from four countries were invited; namely India and Pakistan, which were struck by a great earthquake in 2005 in Kashmir; Indonesia, which suffered the Indian Ocean Tsunami triggered by the Sumatra Earthquake in 2004 and the Earthquake on the Javanese Island in 2004; and Korea, which had suffered a big forest fire.

ITC 2007

In 2007, R-DMUCH exchanged MOU with ICCROM and established a criterion for choosing participants with the support of ICCROM. As a result, eight trainees from Bangladesh, China, Peru and Philippines were invited for the training course.

Based on the experience of 2006 training course, it was decided to make closer relation between the lectures, site visits and workshops. Therefore in 2007, several related sets of lectures were held in the mornings and workshops in the afternoons. Based on these, discussions were facilitated by the instructors so that the trainees were able to reflect more effectively on the challenges for cultural heritage disaster management within their own context.

ITC 2008

The 2008 training course actively built upon the rich experience gathered during the courses held in the previous two years. This year had participants from five countries from Asia and Europe, namely Nepal, Bhutan, Iran, Serbia and Chinese Taipei. Effort was made to make this year's course, more field-based by drawing upon the unique opportunity offered by the location of important World Heritage Sites in Kyoto such as Kiyomizu-dera and Ninna-ji temples. Most of the workshops were, therefore, based on field work undertaken by the participants in these sites. This year's course also put greater emphasis on exposing the participants to the methodology for undertaking disaster risk assessment for cultural heritage sites.

ITC 2009

The 2009 training course further evolved on the basis of rich feedback provided by the participants of the training courses from previous years. In response to the need for making the course more relevant to specific requirements and constraints of the developing countries, it was decided to

organize the course partly in Japan and partly in Nepal.
Moreover, for the first time, the training course had a specific theme, namely "Earthquake risk management of Historic Urban Areas." For this purpose, Kyoto and Kathmandu; two historic cities with rich cultural heritage but extremely vulnerable to earthquakes, were chosen as the case study sites for undertaking field exercises during the training course.
The first week of the course was organized in Japan and it focused on familiarizing the participants with the basic methodology for risk assessment and management for cultural heritage properties. The participants were shown various disaster prevention facilities developed for numerous cultural heritage sites in Kyoto. Second week in Kathmandu focused on the earthquake vulnerability and capacity of the World Heritage Monument Zone of Patan and its surrounding historic urban area, both at building and area levels.
The UNESCO Chair programme intends to build upon the four years of very rich experience gained through very active participation of lecturers from Japan and abroad, as well as the international participants from various countries from Asia, Europe and the Caribbean and further enrich the contents of the training course in subsequent years.

ITC 2010
Fifth UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage 2010 was held from 13 to 26 September 2010 in Kyoto, Kobe and Sasayama, Japan. In the light of destructive Haiti earthquake on January 2010, this fifth International Training Course especially focused on emergency response and long term recovery of wooden and masonry composite Cultural Heritage from disasters. It was attended by 11 participants from 5 countries; Bhutan, Palau, Peru, Serbia and Turkey.

On the final day of the course, the international symposium titled "How to protect Cultural Heritage from Disaster; Risk Preparedness and Post Disaster Recovery" was organized by Ritsumeikan University and the ICOMOS International Committee on Risk Preparedness (ICORP). In the symposium, the current challenges for protection of cultural heritages taking into account the context of post disaster recovery was discussed in great depth with international experts from UNESCO, ICOMOS, ICORP and a representative of Kyo-o-Gokokuji Temple; World Cultural Heritage site in Kyoto.

ITC 2011
Sixth UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage was held from 10 to 24 September 2011 in Kyoto, Kobe and Tohoku area of East Japan. In the light of increasing vulnerability of rapidly urbanizing settlements, the course focused on "Integrated Approach for Disaster Risk Mitigation of Historic Cities". The course was attended by 11 participants from 8 countries; Columbia, Jamaica, Kenya, Uganda, China, Mexico, India and Bangladesh.

ITC 2012
Seventh International Training Course on Disaster Risk Management of Cultural Heritage held during September 2012 in Kyoto, Kobe and Tohoku area of East Japan focused on sustainable recovery of cultural heritage. Accordingly the theme of the course was **"From Recovery to Risk Reduction for Sustainability of Historic Areas".**

ITC 2013
The theme of the 8th UNESCO Chair International Training Course on Disaster Risk Management of Cultural Heritage was **"Reducing Disaster Risks to Historic Urban Areas and Their Territorial Settings through Mitigation".** The course focused on policies and planning measures for mitigating risks to cultural heritage from multiple hazards such as earthquakes, floods, landslides and fires, especially in rapidly urbanizing context of developing countries. Special techniques for mitigating risks from earthquakes and fires were also highlighted besides policies, planning and design

interventions for long term restoration and rehabilitation of cultural heritage following disaster through a special workshop in the area affected by the Great East Japan Disaster in 2011.

Organizers and Participants

The training course has been organized from the beginning in cooperation with the UNESCO World Heritage Centre, ICCROM, ICOMOS and relevant institutions of the government of Japan. In 2014, the Toyota Foundation "Initiative Program" has proposed to support our training course by providing the budget. Participants will include managers of cultural heritage, disaster risk management experts, decision makers and government officials involved in cultural properties or disaster management.

Participants List of the Previous Training Courses

ITC 2006, the 1st year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Poonacha KODIRA	INDIA	Director (Conservation), Ministry of Tourism and Culture Archaeological Survey of India	Earthquake Hazard and Vulnerability aspects for the WH Site of Qutub Complex, New Delhi and Proposed Management System
2	Anup KARANTH	INDIA	Project Coordinator, Urban Earthquake Vulnerability Reduction Project, United Nations Development Programme (UNDP) India	
3	Sektiadi	INDONSESIA	Lecturer, Dept. of Archaeology, Faculty of Culture Sciences, Gadjah Mada University	Mitigation and Emergency Preparedness Plan for the Protection of WH Site of Prambanan and its Surrounding Environment from Earthquake
4	Manggar AYUATI	INDONESIA	Supervisor of Rescue on Preservation Division, Dept. of Cultural and Tourism, Center for Preservation of Cultural Heritage of Yogyakarta Province	
5	Fauzia QURESHI	PAKISTAN	Head of the Department of Architecture, National College of Arts, Lahore	Long Term Maintenance Plan for Mitigation against Floods for WH Site of Rohtas Fort
6	Hussain KHADIM	PAKISTAN	Coordinator, Disaster Management Desk RDPI, Rural Development Policy Institute	
7	Seok JEONG	KOREA	Government employee of Modern Construction Field, Tangible Cultural Heritage Bureau, Cultural Heritage Administration, Republic of Korea	Emergency Preparedness Measures for the Protection of Folk Village of Hahoe in Andong City from Fire
8	Woongju SHIN	KOREA	Concurrent Professor, Dept. Interior Architecture, Chosun College of Science and Technology	

ITC 2007, the 2nd year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	A.K.M. Monowar Hossain AKHAND	BANGLA-DESH	Deputy Secretary, Ministry of Home Affairs, GOVT. of Bangladesh	Disaster Risk Management Plan for Lal Bagh Fort, Dhaka, Bangladesh
2	Md. Rafiqul ALAM	BANGLA-DESH	Executive Director, DWIP UNNAYAN SONGTHA (DUS)	
3	Shijun HE	P. R. CHINA	Officer of Protection & Construction Office, Protection and Management Bureau of World Cultural Heritage Site - the Old Town of Lijiang	Disaster Risk Management Plan for Case Study Heritage Site on the Old Town of Lijiang
4	Cuiyu HE	P. R. CHINA	Staff of Engineering & Project Dept., Protection and Management Bureau of World Cultural Heritage Site - the Old Town of Lijiang	
5	Maria Del Carmen CORRALES PEREZ	PERU	Instituto Nacional De Cultura Architect of the conservation and Restoration Sub Direction	Disaster Risk Management Plan of Lima Historical Center
6	Partricia Isabel GIBU YAGUE	PERU	Chief of Laboratory of Structures, Japan-Peru Center for Earthquake Engineering Research and Disaster Mitigation	
7	Glen CONCEPCION	PHILIPPINES	City Disaster Action Officer and City Environment & Natural Resources Officer, City Government of Vigan	Vigan Disaster Risk Management Plan for Cultural Heritage
8	Eric QUADRA	PHILIPPINES	Architect, LGU-Vigan City	

ITC 2008, the 3rd year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Choening DORJI	BHUTAN	Architect, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home & Cultural Affairs Royal Government of Bhutan	Disaster Risk Management Plan for Tashichhodzong
2	Karma TENZIN	BHUTAN	Civil Engineer, Tashichhodzong Maintenance Division, Dzongkhag Administration	
3	Mahmoud NEJATI	IRAN	Deputy of Research & Technical Consultant, Recovery Project of Bam's Cultural Heritage	Disaster Risk Management for Bam's Cultural Heritage
4	Fatemeh MEHDIZADEH SARADJ	IRAN	Assistant Professor, Department of Conservation, Iran University of Science and Technology	

5	Kai Ube Prasad WEISE	NEPAL	Architect, Planners' Alliance for the Himalayan & Allied Regions	Disaster Risk Management Plan for Kathmandu Valley WH Site Patan Durbar Square Monument Zone
6	Suman Narsingh RAJBHANDARI	NEPAL	Assistant Professor, Nepal Engineering College	
7	Ivana FILIPOVIC	SERBIA	Architect Conservationist, Cultural Heritage Preservation Institute of Belgrade	Disaster Risk Management Plan for Lower Town in Belgrade Fortress
8	Shang Chia CHIOU	TAIWAN	Professor, Department of Architecture and Interior Design, National Yunlin University of Science & Technology	Disaster Risk Management Plan for Fort San Domingo in Tamsui and Surround Historical Buildings
9	Shen Wen CHIEN	TAIWAN	Associate Professor, Department of Fire Science, Central Police University	

ITC 2009, the 4th year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Rong YU	P. R. CHINA	Lecturer, Wenhua College, Huazhong University of Science and Technology	Dujiangyan, the World Heritage Site
2	Yuan DING	P.R.CHINA	Researcher, Tongji University, National Historic Cities Research Center	
3	Ramesh THAPALIYA	NEPAL	Architect, World Heritage Conservation Section/Ministry of Culture and State Restructuring, Department of Archaeology	Patan Durbar Protected Monument Zone
4	Suresh Suras SHRESTHA	NEPAL	Archaeological Officer, Ministry of Culture and state Restructuring, Department of Archaeology	
5	Pauline BROWN	JAMAICA	Senior Director, Office of Disaster Preparedness and Emergency Management	Port Royal City
6	Audene BROOKS	JAMAICA	Senior Archaeologist, Jamaica National Heritage Trust	
7	Sergius CIOCANU	MOLDOVA	Head Scientific Researcher, Institute of Cultural Heritage of the Academy of Science of Moldova	National Museum of Fine Arts (Buildings and Collection)
8	Valeria SURUCEANU	MOLDOVA	Curator, National art Museum of Moldova	

Observers in the Kathmandu Part of the ITC 2009

No	Name	Country	Work Position and Affiliation
1	Keshab P. SHRESTHA	NEPAL	Chief, National History Museum
2	Punya Sagar MARAHATTA	NEPAL	Lecturer, IoE, tribhuvan University
3	Ajay LAL CHANDRA	NEPAL	Assistant Professor, Department of Architecture and Urban Planning, IoE
4	Gyanin RAI	NEPAL	Chief (Administration, Information & Public Relation Section), Lumbini Development Trust
5	Inu PRADHAN SALIKE	NEPAL	Lecturer, Khwopa Engineering College
6	Saubhagya PRADHNANGA	NEPAL	Head of Culture and Archaeology Unit, Lalitpur Sub Metropolitan City Office
7	Chandra Shova SHAKYA	NEPAL	Head of Heritage Section, Lalitpur Sub Metropolitan City Office
8	Prabin SHRESTHA	NEPAL	Head of Urban Development Division, Lalitpur Sub Metropolitan City Office
9	Ashok SHRESTHA	NEPAL	Head of Administration Division, Lalitpur Sub Metropolitan City Office
10	Sainik Raj SINGH	NEPAL	Head of Earthquake Safety Section, Lalitpur Sub Metropolitan City Office

ITC 2010, the 5th year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Dechen TSHERING	BHUTAN	Structural Engineer, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home & Cultural Affairs, Royal Government of Bhutan	Wangduephodrang Dzong
2	Junko MUKAI	BHUTAN	Deputy Chief Conservation Architect, Division for Conservation of Heritage Sites, Department of Culture, Ministry of Home and Cultural Affairs, Royal Government of Bhutan	
3	Alexander G DWIGHT	PALAU	Director, Historical Preservation Officer, Bureau of Arts & Culture, Ministry of Community & Cultural Affairs	Airai Bai, Ngkeklau Bai, Melkeok and Koror Bai
4	Sunny NGIRMANG	PALAU	Palau National Registrar, Bureau of Arts & Culture, Palau Historic Preservation Office	

5	Teresa VILCAPOMA HUAPAYA	PERU	University Professor, Sagrado Corazon University	Historical Centre of the City of Arequipa
6	Olga Keiko MENDOZA SHIMADA	PERU	Doctor Course Student, JSPS Research Fellow, Graduate School of Science & Engineering, Ritsumeikan University	
7	Marilene TERRONES DIAZ	PERU	University Professor, Sagrado Corazon University	
8	Milica GROZDANIC	SERBIA	Director, Cultural Heritage Preservation Institute of Belgrade	Belgrade's samples of Oriental-Balkan architecture (Princess Ljubica Residence, Prince Milos Residence, Tavern "?", Dositej's Lyceum etc.)
9	Svetlana Dimitrijevic MARKOVIC	SERBIA	Architect - Conservator - Senior Associate, Cultural Heritage Preservation Institute of Belgrade	
10	Zeynep GUL UNAL	TURKEY	Assistant Professor, Dr. Yildiz Technical University, Faculty of Architecture, Restoration Department	Kütahya District
11	Meltem VATAN KAPTAN	TURKEY	Research Assistant, PhD Student, Yildiz Technical University, Faculty of Architecture, Structural Systems Division	

ITC 2011, the 6th year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Celina RINCON	COLOMBIA	Assessor for the Heritage Director Office, Ministry of Culture	History center of Santa Cruz de Mompox
2	Cheryl NICHOLS	JAMAICA	Training Manager, Office of Disaster Preparedness and Emergency Management	The Holy Trinity Cathedral
3	Jose Ramon PEREZ OCEJO	MEXICO	Part-time Teacher, Universidad de las Américas (Puebla, MEXICO)	Colonial City Centre of Puebla
4	Julius MWAHUNGA	KENYA	Senior Cultural Officer, Ministry of State for National Heritage and Culture, Department of Culture	Lamu Old Town
5	Remigius KIGONGO	UGANDA	Conservator Sites and Monuments/ Site Manager, Department of Museums and Monuments	Kasubi Tombs
6	Janhwij SHARMA	INDIA	Director (Conservation and World Heritage), Archaeological Survey of India, Ministry of Culture	Taj Mahal

7	Md. Aamir Hussain SHIKDER	BANGLA-DESH	Urban Local Body Coordinator, Bangladesh Municipal Development Fund (BMDF)	Mosque city of Bagerhat
8	Qing WEI	P. R. CHINA	Deputy Director, Cultural Heritage Conservation Center, THAD	Kulangsu
9	Yu WANG	P. R. CHINA	PhD Candidate, Urban Design and Planning Department, Norwegian University of Science and Technology (NTNU)	Taoping Qiang Village

ITC 2012, the 7th year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Suzie YEE SHOW	FIJI	Secretary General, ICOMOS PASIFIKA	Levuka Town
2	Vikas LAKHANI	INDIA	Sector Manager, Gujarat State Disaster Management Authority	Champaner - Pavagadh Archaeological Park, Panchamahal District, Gujarat, WHS
3	Sang sun JO	KOREA	Research Associate and Curator, Heritage Repair Division, Cultural Heritage Administration of KOREA	Jongmyo Shrine, WHS
4	Rosli BIN HAJI NOR	MALAYSIA	Head of Melaka World Heritage Office, Melaka World Heritage Office	Historic City of Melaka, WHS
5	Ni LEI WIN	MYANMAR	Communications Officer at World Concern Myanmar, Relief, Recovery and Development Project in Myanma	Bagan located in Manadalay Division, Myanmar
6	Helen McCRACKEN	NEW ZEALAND	Policy Adviser - Heritage, Ministry for Culture and Heritage	Cuba Street Historic Area, Wellington
7	Usman SHAMIM	PAKISTAN	Programme Officer, Kuchlak Welfare Society (KWS)	Mehrgarh, lies on the "Kachi plain" of now Balochistan, Pakistan
8	Poorna YAHAMPATH	SRI LANKA	Consultant - External Resource Person, Disaster Risk Management & Climate Change for GIZ	Sacred City of Kandy, Sri Lanka, WHS
9	Sibel YILDIRIM ESEN	TURKEY	Conservation Architect, Ministry of Culture and Tourism	Agora Archeological Site in the Historic City of Izmir

Observers

No	Name	Country	Work Position and Affiliation
1	Dong Seok KANG	KOREA	A Section Chief of GIS, Cultural Heritage Administration
2	Thi My Thi TONG	VIET NAM	PhD Student, International Environmental and Disaster Management Laboratory, Graduate School of Global Environmental Studies, Kyoto University

ITC 2013, the 8th year

No	Name	Country	Work Position and Affiliation	DRM Plans of Cultural Heritage Formulated by the Participants
1	Saleh Mohammad SAMIT	AFGHA NISTAN	National Manager, Community Development Programme Aga Khan Foundation-Afghanistan	Important sites in Bamyan Province, including Provincial capital of Bamyan
2	Dian LAKSHMI PRATIWI	INDONESIA	Head of Archaeological Section, Division of History, Archaeological and Museum, Cultural Service Office, Government of Yogyakarta Special Territory	Yogyakarta Historic City (Case Study: Cultural Heritage Area of Kraton, Kotagede and Imogiri)
3	Kambod AMINI HOSSEINI	IRAN	Director, Risk Management Research Center (Associate Professor) Risk Management Research Center, International Institute of Earthquake Engineering and Seismology	Tehran Bazaar, Golestan Palace and their surrounding old urban fabrics/ Tehran, Iran
4	Barbara CARANZA	ITALY	MEC srl Italian Army "LIGURIA" ARMY MILITARY COMMAND	Staglieno Monumental Cemetery of Genoa
5	Paola MUSSINI	ITALY	Researcher, SiTI-Instituto Superiore sui Sistemi Territoriali per l'Innovazione	Portovenere, Cinque Terre, and the Islands (Palmaria,Tino and Tinetto)
6	Zaha AHMED	MALDIVES	Assistant Architect, Heritage Department, Male' Republic of Maldives	Laamu atoll Isdhoo Old Friday mosque in Maldives
7	Arjun KOIRALA	NEPAL	Advisor, Urban Planning and Infrastructure Development, GFA Consulting Group (Nepal Office), on behalf of GIZ/ Nepal Municipal Support Team, Ministry of Urban Development, Department of Urban Development and Building Construction	The city core area of Tansen Municipality
8	Kenechukwu Chudi ONUKWUBE	NIGERIA	Director of Programs, Development Education and Advocacy Resources Initiative for Africa (DEAR Africa)	Sukur Cultural Landscape Nigeria
9	Muhammad Juma MUHAMMAD	TANZANIA	Director, Urban and Rural Planning Department of Urban and Rural Planning	Zanzibar Stone Town
10	Hatthaya SIRIPHA TTHANAKUN	THAILAND	Landscape Architect Ministry of Culture, Fine Arts Department, Office of Architecture	Historic City of Ayutthaya

1.2 Timetable of UNESCO Chair Programme on Cultural Heritage and Risk Ma
Management of Cultural Heritage 2014, 9th year, Ritsumeikan University

	9/5 Fri	9/6 Sat	9/7 Sun	9/8 Mon	9/9 Tue	9/10 Wed	9/11 Thu	9/12 Fri	9/13 Sat
THEME	Arrival	Introduction and The First Presentation	Core Principle and Value	Principles, Framework and Risk Analysis at Site Level	Risk Assessment at Urban Level	Disaster Scenarios for Prioritization	Risk Prevention and Mitigation	Emergency Preparedness and Response	The Middle Presentation
Venue		DMUCH	DMUCH	Kiyomizu-Dera	Sannei-Zaka	DMUCH	DMUCH	Ninna-Ji	DMUCH
9:00		Registration	Lecture 3 Disaster Risk Management of Cultural Heritage - Significance and Core Principles (R.JIGYASU)	Recap	Recap	Recap	Recap	Recap	
10:00		Opening Address Orientation to the Course (R.JIGYASU)		Lecture 5 Introduction to the Context of Japanese Wooden Cultural Heritage (N.TSURUOKA, Kyoto Pref.)	Lecture 7-1 Disaster Imagination Game (DIG) (T.OKUBO) to Sannei-Zaka	Lecture 8 Ecology and Sustainability of Historic Urban Areas (S.MOFFATT)	Lecture 11 Introduction to the Integrated Methodology for Assessing Risks (R.JIGYASU)	to Ninna-Ji Self Study	
11:00			Lecture 4 Assessing the Values of Cultural Heritage (R.JIGYASU)		Site Visit 2 and Field Work Sannei-Zaka Important Preservation District (T.OKUBO)			Site Visit 3 World Heritage Site Fire Prevention Facilities at Ninna-Ji Temple (H.OMORI)	
12:00		Lecture 1 The Need for Disaster Risk Management for Cultural Heritage in Historic Cities: The Case of Kyoto (K.TOKI)	Workshop 1 Assessing the Values (R.JIGYASU)	Lecture 6 Dynamic Analysis of Earthquakes and Seismic Performance of Japanese Historical Structures (K.IZUNO)		Lecture 9 Disaster Mitigation and Integrated Planning of Historic Cities' (S.MOFFATT)	Lecture 12 LANDSLIDE, Prevention and Mitigation Techniques (R.FUKAGAWA)		
13:00		Lunch	Lunch	Lunch	to DMUCH	Lunch	Lunch	to DMUCH	Lunch
14:00		The First Presentations by the Training Participants/ Cultural Heritage and Disaster	Self-Study	to Kiyomizu-Dera Site Visit 1-1 Observations of Risks at WHS in Kiyomizu-Dera (N.TSURUOKA, Kyoto Pref.)	Lunch Workshop 3 Risk Assessment Exercise: Presentation and Discussion on DIG (T.OKUBO)	Lecture 10 Engaging Communities for Disaster Risk Reduction (R.SHAW)	Lecture 13 Risk Assessment of Archaeological Heritage at Territorial Scale. The Case of Izmir Metropolitan Area (S.ESEN)	Lecture 16 Disaster Prevention for Cultural Heritage in Kyoto City (Y.MACHIDA, Kyoto City FD)	
15:00				Site Visit 1-2 Observations of Risks at WHS in Kiyomizu-Dera (FUJIMOTO, ISHIDA)		Workshop 4 Building Disaster Risk Scenarios (S. MOFFATT)	Lecture 14 Flood Prevention and Mitigation Techniques (K.SAWAI)	Lecture 17 Techniques for Preventing and Mitigating Fire in Historic Buildings (C. MARRION)	The Middle Presentations by the Training Participants
16:00					Lecture 7-2 Disaster Imagination Game (DIG) (T.OKUBO)				
17:00		Lecture 2 Introduction to the Context of Historic City of Kyoto (M.YAMASAKI)		to DMUCH Workshop 2 Impact of Disaster on Cultural Heritage/ in Case of Kiyomizu-Dera Temple, Introduction to Key Terminology (R.JIGYASU)	Case Study Project Work		Lecture 15 GIS for Disaster Management of Historical City, Kyoto (K.YANO)		
18:00						Case Study Project Work	Case Study Project Work	Workshop 5 Role Playing Workshop on Emergency Response (R.JIGYASU)	
19:00		Welcome Dinner							
Accommodation	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto

nagement, International Training Course (ITC) on Disaster Risk

9/14 Sun	9/15 Mon, Holiday	9/16 Tue	9/17 Wed	9/18 Thu	9/19 Fri	9/20 Sat	9/21 Sun	9/2 Mo	9/23 Tue, Holiday
Planning for Recovery: Lessons from Kobe	From Response to Recovery: Great East Japan Disaster	From Response to Recovery: Great East Japan Disaster		Policy for Risk Management	Pilot Project	Pilot Project	DRM	The Last Presentation	Depar ture
Kobe to Sendai	Minami Sanriku-Cho	Minami Sanriku-Cho	Sendai to Kyoto	DMUCH	DMUCH	DMUCH	DMUCH	DMUCH	
to Kobe	to Minami Sanriku	To Kaminoyama-Hachiman-Gu	to Kyoto						
Disaster Reduction and Human Renovation Institution Theater and 3D		Site Visit 5-2 Join the Festival Event			Recap	Recap	Recap		
	Lecture 20 East Japan Great Earthquake and Cultural Heritage (N.ITAYA)	Lecture 21-4 Challenge by the Community (M.KUDO)			Lecture 24 Disaster Risk Management for Ayutthaya World Heritage (H.SIRIPHATTHANAKUN)	Lecture 26 Lessons Learnt from the Recovery Process of Historic South Gate, Seoul (S. JO)	Lecture 28 Management Systems for Heritage Sites (J.KING, ICCROM)	Lecture 30 Making Historic Cities Resilient (J.VELASQUEZ, UNISDR)	
Lecture 18 Experience of the Great Hanshin-Awaji Earthquake, Risk Assessment (Y.MURAKAMI, Hyogo Pref.)		To the hotel							
Lecture 19 Planning for Disaster Mitigation of Cultural Heritage Training of Heritage Manager (Y.MURAKAMI, Hyogo Pref.)	Site Visit 5-1 Minami Sanriku-Cho Affected by the East Japan Disaster (Y.HIRAOKA)	Lecture 22 Cultural Perspectives in Post Disaster Recovery (W.CHEEK)		Lecture 23 Emerging Polices for Disaster Risk Management of Urban Cultural Heritage in Japan (K.SHIMOTSUMA, ACA Japan)	Lecture 25 'You Can Rescue' Initiative (Z.GUL UNAL)	Lecture 27 Post Disaster Recovery of Cultural Heritage after Dujiangyan Earthquake (Q.WEI)	Lecture 29 Hague Convention (A.TAKAHASHI, UNESCO)	Lecture 31 Global Initiaitves for Disaster Risk Management of World Cultural Heritage (G.BOCCARDI, UNESCO WHC)	
Lunch JICA		Lunch		Lunch	Lunch	Lunch	Lunch	Lunch	
	Lunch	Workshop 6 Integrating Cultural Heritage in the Recovery of Minami Sanriku-Cho		Case Study Project Work	Case Study Project Work	Case Study Project Work	Case Study (Resource Persons)	The Last Presentation	
Site Visit 4 After the Kobe Earthquake Site	Lecture21-1 Post Disaster and Recovery Process, Challenge by the Government (Y.HIRAOKA)								
Site Visit 4 After the Kobe Earthquake Site	Lecture21-2 Challenge from the Environment (K.GOTO)						Preparation for the Last Presentation		
	Lecture 21-3 Challenge by the Reconstruction Network (H.OIKAWA)	to Sendai							
to Sendai	Discussion								
								Farewell Party	
Sendai	Minami Sanriku-Cho	Sendai	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	Kyoto	

Organized by Institute of Disaster Mitigation for Urban Cultural Heritage, Ritsumeikan University, Kyoto, Japan
In Cooperation with UNESCO World Heritage Centre, ICCROM, ICOMOS/ICORP
Supported by Toyota Foundation "Initiative Program"

2 Formulating Disaster Risk Management Plans of Historic Cities

2.1 Historic Centre of Gjirokastra, Albania

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1. Introduction

Gjirokastra is one of the most important cultural cities in Albania. In the year 1961, it was proclaimed a Museum City (Decision of the Council of Ministers of Albania Nr. 172, Dt. 02.06.1961) for its unique and rich cultural heritage. Gjirokastra's historic monuments are classified as either 1st category or 2nd category monuments. There are 56 1st category monuments, 540 2nd category monuments, and approximately 1,200 stone buildings throughout the city (Fig. 1).

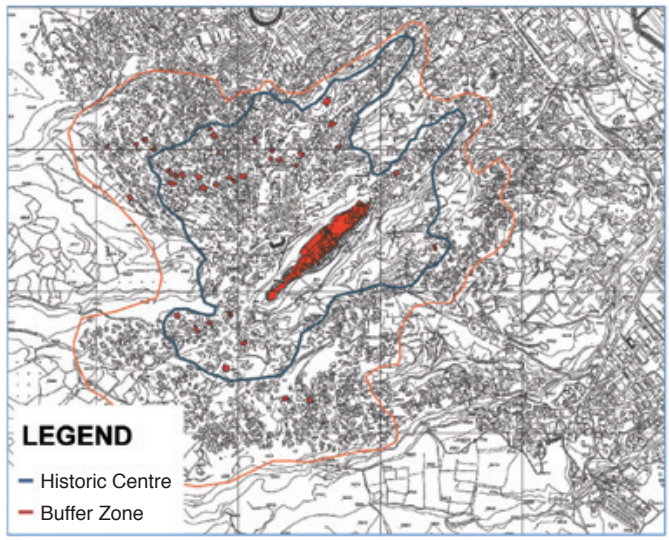

Fig. 1

In 2005, the historic core of Gjirokastra was inscribed as a UNESCO World Heritage Site, under Criterion (iii) and (iv). According to their description:

> *The old city of Gjirokastra is an exceptional testimony to a long-lasting, and almost disappeared society and life-style, influenced by the culture and tradition of Islam in the Ottoman period. The historic town of Gjirokastra is a rare example of a well-preserved Ottoman town, built by farmers of large estates, around the 13th-century citadel. The architecture is characterized by the construction of a type of tower house (Turkish 'kule'), of which Gjirokastra represents a series of outstanding examples (http://whc.unesco.org/en/list/569).*

2. Attributes and Values

Gjirokastra is located in South Albania, in a strategic position above the Drino valley, where there are testimonies of very ancient and important civilisations (i.e. the ancient cities of Antigonea, Hadrianopolis, and Melan). It was built by major landowners and used as an important administrative centre for centuries. The *historic values* of the city are derived from its long and brilliant history but also from its monuments and dwellings which are still very well preserved.
Gjirokastra has inherited a large number of monument buildings including a citadel, vernacular houses and religious buildings. The historic centre contains 7 neighbourhoods situated around the castle (referenced by Evlija Celebi in the 17th century) and the town bazaar.

The architectural values of the city are not only observable in the characteristics of well-preserved individual monuments, but are also seen in the urban architectural-historical complexes of the bazaar and surrounding neighbourhoods. Important contributions to Gjirokastra's architectural values include the landscape and arrangement of houses, the organization of the historic neighbourhoods, the cobble-stone streets, and the preservation of these aspects and of the city as a whole. Additionally, individual monuments have high *technical and aesthetical values*. The materials and the techniques used in their construction prove the high knowledge of the craftsmen of that time regarding the characteristics of the materials and construction techniques. Exemplary of this fact are the beautifully carved ceilings and wooden doors and the colourful paintings of the facades and guest rooms in some of the most well-preserved monument houses (Fig. 2).

Fig. 2 Panoramic photo of the city (left) [photo Kreshnik Merxhani], The castle (right) [photo Alket Islami]

In addition to the city's historic and architectural values, Gjirokastra also has important *social values* that are a testimony to the lifestyle of people in the late medieval period and special influence of Ottoman traditions. The almost unchanged shape of the city and the well-preserved interiors of individual monuments can tell us a lot about the way people were living in that time and about their habits and everyday routines (Fig. 3).

Fig. 3 Interior of Skenduli house [photo Kreshnik Merxhani]

Considering these important and unique values the city has a big potential for tourism and economic development. Tourism has increased since the city's inscription on the list of UNESCO World Heritage Sites. Indeed, the economic potential of Gjirokastra is evidenced by the growing number of visitors every year. Increased tourism is an important economic resource for the owners of historic monuments, responsible institutions and the city as a whole.

3. Natural disasters - Hazards and Vulnerabilities

Gjirokastra's historic zone is vulnerable to a range of natural disasters and human interferences. The political and economic situation in Albania over the last 20 years, coupled with the sheer number of monuments, unresolved ownership issues, and the emigration of the city's residents are some of the main reasons for the lack of preservation and rapid deterioration observable throughout the city.

Although there is no recorded evidence of damage due to seismic activity, the city is located in a high risk seismic zone, and is thus vulnerable to earthquakes. Traditionally, the stone structures of the buildings were reinforced by wooden ties in addition to the ancillary support of the floors, ceilings, and roof which together functioned as an earthquake-resistant structural design. The difficulty of maintaining the wooden earthquake-resistant elements, inappropriate restoration interventions, as well as poor maintenance or negligence contribute to increased vulnerability of historic monuments to earthquakes and other seismic events.

Another natural hazard to the city's monuments is fire. Despite the stone construction of the foundation and exterior, the interiors are wooden and thus vulnerable to fire. Poor electrical installations, exposed un-grounded electric cables, overgrown vegetation, scattered garbage, and uninhabited or abandoned houses are in risk of fires. Considering the lack of effective firefighting mechanisms and personnel, unreliable water supply, as well as the barriers to quick response such as hilly terrain and narrow streets, fire is a big risk to the built heritage of Gjirokastra.

Landslides are a less common natural hazard but also pose a potential threat especially given the rate of deforestation, unregulated development and construction projects, and the effects of climate change which include more frequent and heavy rains (Table 1).

Table. 1

Hazards	
Earthquake	**Fire**
Vulnerabilities	
• Poor quality of Restoration works • Improper interventions • Decay of traditional timber tie rings • Lack of Maintenance • Abandonment	• Lack of hydrants in the area • Lack of continuous water supply • Wooden interiors of the buildings • Poor electric installations in buildings • Exposed, ungrounded electric cables • Response barriers such as narrow and hilly streets • Overgrown vegetation • Scattered garbage • Abandoned buildings • Lack of awareness within the community
Impacts	• Loss of lives • Half ruined and abandoned monuments and those that are destroyed completely • Other monuments have serious structural damages • Loss of the city's architectural integrity • Loss of traditional materials and techniques • Reduced income for local community members

4. Human interferences - hazards and vulnerabilities

Another, perhaps more costly threat to the Museum City of Gjirokastra, is human caused. The effects of human interventions or negligence is often less drastic and less apparent but can be equally as damaging in the long term in comparison to natural hazards. Inappropriate restoration practices, lack of maintenance, abandonment and illegal interventions both increase vulnerability of monuments to earthquakes and detract significantly from the buildings' authentic values. In this way, human interactions with the city's built heritage can be equally as disastrous as earthquakes, fires, and landslides (Table 2, Fig. 4).

Table. 2

Lack of Maintenance	Abandonment	Inappropriate Restoration Practices	Illegal Interventions
Vulnerabilities			
• Unsolved property issues/high number of owners for each monument • Emigration • High costs of restoration		• Long Transition period • Lack of control from responsible institutions • Lack of coordination between institutions	
Impacts			
• Loss of historical monuments • Loss of architectural integrity of the city • Loss of traditional materials and techniques • Reduced income of local community members			

Fig. 4 Second category monument, abandoned [photo Elena Mamani]

5. Mitigation Measures

Planning preventive measures for disasters, either natural or human caused, requires action at different levels and times. There is a need to increase the awareness within the community and among responsible institutions (both local and national) and to develop a Disaster Risk Management Plan (Table 3).

Table. 3

Policy Level	*Planning Level*
• Increase awareness within the community and local/national governments about the risks to CH • Integration of DRMP concept in the National Law for Cultural Heritage • Revision of the law of CH including strengthening measures during Restoration works • Revision of the law on ownership of Cultural Heritage properties • Coordination and cooperation between local and national governments	• Apply for Funds and Build the Team that will work on DRM Plan • Mapping and documenting cultural monuments in danger • Build a strategy for restoration interventions prioritized according to the values of the monument and its structural condition • Fundraising for the proposed actions • Workshops with community members on values of cultural heritage and economic benefits of it.

Technical Level
• Training community members on how to behave in disasters. • Immediate interventions in Cultural Monuments in danger (propping, light covering) • Continuous maintenance of the monuments • Build firefighting system within the neighborhood (Fire distinguishers, hydrants, re usage of private water cisterns within the houses) • Improve firefighting department infrastructure (small trucks that can go easier in the narrow streets) • Improvement of the electrical installations • Maintenance of green areas within the protected area

6. Emergency Preparedness and Response

Emergency preparedness addresses response protocol during a disaster. At this stage, the most important step in developing an emergency response plan is determining appropriate evacuation procedures. The evacuation plan should include the creation of evacuation routes and safe zones in addition to the placement of clear signs throughout the city. In the event of a disaster, it will be important to have an emergency team which will include specialists from responsible institutions as well as trained community members. Coordination of the emergency team and respective institutions is the key to a successful evacuation (Fig. 5).

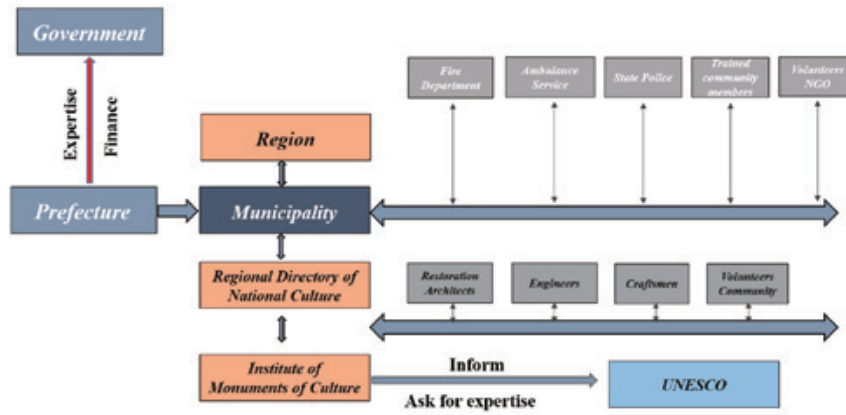

Fig. 5 Emergency Team

7. Recovery activities

Following a disaster, recovery activities should include an assessment of the damage and plans for the reconstruction. These activities should be guided by prioritizing needs, feasibility of reconstruction, and strengthening existing and future response mechanisms. Planning and reconstruction should be conducted according to short, mid and long term activities. It is important to designate the institutions and bodies responsible for the implementation of each activity.

Short term actions:

- *Rescue* (Fire department, Ambulance Services, Volunteers)
- *Cleaning the affected areas, removal of debris* (Under supervision of heritage specialists)
- *Damage assessment of the built heritage* (DRKK/IMK/NGO, International experts)

Midterm actions:

- *Proposal for emergency interventions / Budgeting* (DRKK/IMK/NGO, International experts)
- *Fundraising* (Government/Private/Organizations)
- *Propping the damaged buildings, light roof covering* (Restoration Companies under the Supervision of DRKK)

Long term actions:

- *Develop strategy for restoration interventions* DRKK/Municipality/IMK/NGO/Government)
- *Educational and awareness workshops with the community* (Prefecture/Municipality/DRKK/NGO)
- *Restoration and Reconstruction of damaged heritage buildings and the natural environment* (Restoration companies)
- *Rehabilitation of damaged infrastructure installation* (Municipality)
- *Continuous maintenance of the monuments* (Owners)
- *Build a DRM Plan of the site* (Local and central responsible institutions

Pilot project:

The first step to be implemented is a survey of the current status of historic monuments. The survey would be a risk assessment of 1st and 2nd category monuments in Gjirokastra's historic zone.
The results of the survey will be summarized in a report that will be used to alert the government about the state of the risk of historic monuments and devise a set of specific strategies relating to the World Heritage Site of Gjirokastra.
Additionally, DRM plans will be introduced through lectures in Regional Restoration Camps (RRC) organized by CHwB, as a needed tool to protect Cultural Heritage from Disasters. Regional Restoration Camps are training courses on conservation of CH, organised 5 times per year in 4 different countries around the Balkans. They gather students and young professionals from all over the Balkans and around the world. Camps will be used as an opportunity to raise the awareness and address the need of preparing and implementing DRM Plans in their respective countries.

References

1) http://whc.unesco.org/en/list/569
2) Notes from lectures during UNESCO Chair Programme on Cultural Heritage and Risk Management, International Training Course (ITC) on Disaster Risk Management of Cultural Heritage 2014
3) Disaster Risk Management of Cultural Heritage in Urban Areas – A Training Guide, R. Jigyasu, V. Arora, Research Centre for Disaster Risk Management of Cultural Heritage, Ritsumeikan University, Kyoto, Japan.

2.2 Disaster Risk Management Planning for Cultural Heritage Sites in Australia: Case Study - The Rocks, Sydney, Australia

Catherine FORBES
Built Heritage Advisor, GML Heritage; Australian Institute of Architects, Australia ICOMOS, Australia

1. The Australian Context

In her iconic Australian poem, My Country, Dorothea Mackellar describes a land that is almost synonymous with disaster - severe droughts, floods, fires and famines[1)]. She writes:

…..
I love a sunburnt country,
A land of sweeping plains,
Of ragged mountain ranges,
Of droughts and flooding rains.
I love her far horizons,
I love her jewel-sea,
Her beauty and her terror -
The wide brown land for me!
…..
Core of my heart, my country!
Land of the Rainbow Gold,
For flood and fire and famine,
She pays us back threefold -
…..

Although many Australians may feel the same attachment to the land that Dorothea Mackellar writes about, most Australians live on the edge of the island continent, in cities that are far removed from the land that she describes. Even so, for the edge dwellers, severe climatic hazards such as cyclones, hailstorms, heat waves and other extreme weather events are regular phenomena. Savage winds, flash floods and wild fires extend their fingers right into the hearts of our cities. Because Australia is so large, spanning many climatic zones, flood, cyclone and fire can all be raging simultaneously across vast areas of land. Such factors stretch our emergency services to their absolute limits. Other less frequent natural hazards such as earthquake, tsunami and landslide, and human hazards such as industrial accidents and mine subsidence, also contribute to the risks that Australians face.

With each incident, Australia has developed and refined an efficient emergency response using both professional and well trained volunteer services. Even so, disaster still strikes with the loss of life, property, livelihoods and our cultural heritage. Although we have emergency plans for all types of disaster, very few include consideration of the cultural heritage that may be impacted by the disaster or the response to it. Nor do they consider the sense of loss that is experienced by the people when their heritage and connection to their past is destroyed.

Similarly, although Australia has developed strong heritage management principles and practices, most of our heritage places rarely consider the impacts of disaster in their management planning. Or if they do, it is not discussed or coordinated with the emergency services that will provide the response in a given situation. It is rare that an adequate methodology is developed and integrated into the management of a heritage site during and after a disaster.

2. Case Study - The Rocks, Sydney

This case study looks at the potential hazards that affect Sydney, Australia's oldest and largest city. The risks to its cultural heritage, in particular to the historic urban precinct of The Rocks, and potential mitigation strategies for reducing the impacts of disaster on heritage attributes and values are considered, as are ways of coordinating with the local community, government and disaster specialists to ensure that the heritage values of the place are protected before, during and following a disaster.

The Rocks is currently managed by the Sydney Harbour Foreshore Authority (SHFA), on behalf of the NSW State Government who owns the majority of the properties within the precinct.

3. Geographic Context

The Rocks is located on the edge of Sydney Harbour, at the foot of the Sydney Habour Bridge and overlooking Circular Quay and the Sydney Opera House. It is within the buffer zone of the Sydney Opera House World Heritage site, and inversely, the Opera House, the Harbour Bridge and the harbour all form part of the buffer zone for The Rocks. This buffer zone also includes Observatory Hill, the neighbouring residential area of Miller's Point and the port area of Walsh Bay, which all occupy the same headland and, to some extent, share the same history (Fig. 1).

Fig. 1 The Rocks Urban Heritage Precinct, outlined in yellow, is located on the edge of Sydney Harbour

Its buffer zone including Circular Quay and the Sydney Opera House to the east, Sydney Harbour Bridge and Milson's Point to the north, and Observatory Hill, Millers Point and Walsh Bay to the west, is outlined in green. The heritage attributes referred in this study are shown in red. Elevated roads enclose the precinct to the south and west. (Adapted from Google Maps satellite image, dated 10 September 2014)

4. Historic Context

The Rocks is the site of first white settlement in Australia, although for our Aboriginal people it is regarded as the place of invasion. It is the place where, in 1788, convicts were first put ashore onto the rocky outcrops at the edge of Sydney Cove to establish the new British colony of New South Wales. It was a penal colony without walls and the convicts became active contributors to the creation and success of the settlement that has since become the thriving City of Sydney[2].

In the early years of settlement The Rocks was the economic centre of the new colony. As the principal port, it was the place of trade as well as the place of arrival for new immigrants. Gradually, small wattle and daub cottages replaced the original tents, and in turn these were replaced by more substantial tenement row houses, shops, hotels, port facilities and warehouses. Following an outbreak of Bubonic Plague in 1900, the whole area, including Millers Point, was resumed by the NSW Government to raze the unsanitary housing that had developed and to extend the commercial and port facilities. Although many houses were demolished for larger scale development, including the construction of the Sydney Harbour Bridge (1925-1932), examples of all building types and stages of development still survive within the historic precinct and now provide a stark contrast to the modern city adjacent (Fig. 2).

Fig. 2 View looking southeast over The Rocks heritage precinct towards Circular Quay and Sydney's central business district

When major redevelopment and modernization was again proposed during the 1950s and 1960s, The Rocks became one of the first places in Australia where Australians recognized, stood up for and fought to save their heritage through a series of public protests and Green Bans, imposed by the Builders Labourers' Federation on all demolition work. Thus, The Rocks has survived and is now an area much loved by Sydney siders, who continue to fight to save the buildings within its boundaries, including most recently the former Maritime Services Building, now occupied by the Museum of Contemporary Art (Refer to Fig. 8).

5. Geological Context

The Rocks was named for the geological foundations on which it was established. The sandstone bedrock and outcrops onto, into and out of which the new settlement was constructed still dominate the urban landscape. Despite several attempts to give the area a new name, 'The Rocks' remains.

6. Social and Economic Context

With over 14 million visits per year[3)]. The Rocks is a thriving tourist destination for both local and international visitors. Linking two of Sydney's cultural icons, the Sydney Opera House and the Sydney Harbour Bridge, the area contains many restaurants, hotels, retail outlets, offices, street markets (food and crafts), art galleries and museums. The area also contains public housing accommodating both elderly and disabled residents, mainly on the higher slopes. Although the cargo ships that docked at The Rocks have now been relocated to Port Botany, the place still overlooks the busy commuter ferry wharves of Circular Quay and provides port facilities for large

cruise ships during the summer months (Refer to Fig. 2).
The Rocks is a place where the people of Sydney go to celebrate as well as to enjoy catching up with friends over a meal. It provides a stage for special events such as Vivid (the annual winter festival of light) and a viewing platform for the crowds who come to watch the fireworks over the harbour on New Year's Eve and Australia Day. It is also a place where people come to celebrate their own personal special occasions. The Rocks is alive 24 hours a day, 7 days a week and 365 days a year.

7. Heritage Values

The Rocks is of national heritage significance to the people of Australia. It has historic value as the site of first white settlement or place of invasion. But more than this, the precinct encapsulates the history of Sydney within its boundaries as it retains examples of all types and stages of development from the first convict settlement to the contemporary city, providing a rich backdrop to the activities that occur within it.
The sandstone materiality of the site, the complex and chaotic pattern of streets and narrow laneways that respond to its rugged terrain, the richly layered streetscapes with their variety of building types and the views over the busy working harbour to the Sydney Opera House and the Sydney Harbour Bridge give The Rocks exceptional aesthetic and architectural values (See Fig. 3). In addition, as a tourist destination the place has high economic value and as a place of celebration and contemporary social activity The Rocks has a very high social value to the people of Sydney.

Fig. 3 View looking north along George Street to the Sydney Harbour Bridge and northeast over Circular Quay to the Sydney Opera House

8. Heritage Attributes

The Rocks contains many attributes that are listed as heritage items on the NSW State Heritage Register (SHR) [4]. Heritage attributes considered for the purposes of this study include:

- Cadman's Cottage, the former coxswain's barracks and the oldest surviving building in The Rocks precinct, built 1816 (Fig. 4);
- Unwin's Stores, a terrace of five shop tenement houses, built during the 1840s to service the sailors and new immigrants arriving at the wharves located along The Rocks shoreline (Fig. 5);
- Campbell's Stores, a row of ten substantial stone warehouses, built during the 1850s adjacent to the first private wharf in the city and the only surviving nineteenth century warehouse group within the precinct (Fig. 6);

- the Argyle Cut, carved by the convicts through the sandstone ridge to provide access to the neighbouring Millers Point (Fig. 7);
- the sandstone sea wall, constructed from the rock removed from the Argyle Cut to contain a broad flat area of reclaimed land created to extend the deep water port facilities of the city (Fig. 6);
- the archaeological remains of the first government dockyard located below First Fleet Park, the Museum of Contemporary Art (Fig. 8) and the bottom end of Argyle Street, as well as those associated with Cadman's Wharf and Campbell's Wharf; and
- the narrow lanes and stairs that provide the vertical connection between the streets running north south following the natural contours of the site (Fig. 9 and 10).

Fig. 4 Cadman's Cottage, former coxswain's barracks, and archaeological site of Cadman's wharf

Fig. 5 Unwin's Stores, terrace of five shop houses, George Street

Fig. 6 Campbell's Stores located on reclaimed land behind a stone sea wall

Fig. 7 The Argyle Cut, Argyle Street

Fig. 8 Museum of Contemporary Art, located on the archaeological site of the first Government dockyard

Fig. 9 Suez Canal pedestrian lane linking Harrington Street and George Street

Fig. 10 The Argyle stairs linking Argyle Street to Cumberland Street

9. Hazards and Two Disaster Scenarios

For the purposes of this study two disaster scenarios are considered. The first is associated with the most common natural hazard to affect Sydney, that of a severe hailstorm. Although costly in terms of the damage that it can reek on the historic fabric of the precinct, both in the short and the long term, the impacts arising from this type of event should generally be recoverable, if well managed. The second scenario to be considered, with a potentially much more disastrous outcome for the heritage values of The Rocks, is that caused by an earthquake, which is likely to be accompanied by fire.

Severe storms accompanied by lightning strikes, torrential rain, gale force winds and large hail are a regular occurrence in Sydney, bringing with them flash floods, fallen trees, twisted power lines and smashed roofs. The damage bill from the Sydney Hailstorm of 1999, during which 9cm hailstones damaged 20,000 properties and 40,000 vehicles, was in excess of $1.7billion, making it the most costly disaster in Australian history to that date[5]. According to the CSIRO the number of large hail days experienced on the east coast of NSW has been steadily increasing over recent years[6]. Climate data shows that wind gusts can reach up to 150km per hour and that on at least three occasions in the last 150 years (1861, 1950 and 1990) rain has fallen well in excess of 600mm within a 24 hour period[7].

Sydney is located in a moderate earthquake hazard zone[8]. Although there have been no major earthquakes within the Sydney Basin in recent history, hundreds of smaller quakes have been recorded[9]. In addition, significant quakes (magnitude 5.6 on the Richter scale) have been recorded around the edges of the Sydney Basin at Penrith (western Sydney) in 1899, Bowral, Robertson and Picton (southwest of Sydney) in 1961 and 1973 and in Newcastle in 1989. This last event caused considerable loss of life and damage to the built heritage of the city. The relatively short history of European settlement in Australia means that there is a general lack of data available to determine the likelihood of larger quakes within the Sydney Basin. Recent studies, however, indicate that they should be anticipated, especially considering the fault zones crisscrossing the city. Of particular interest are the GPO Fault Zone that lies immediately below the city centre and the Luna Park Fault Zone located just across the harbour at Milson's Point[10].

Other potential hazards that could be considered for Sydney and The Rocks include tsunami, rising

sea levels and fire. Over the last 150 years only relatively minor tsunamis have been recorded at Fort Denison in the centre of Sydney Harbour[11]. However, geological evidence indicates that much larger events have occurred in the past. It is predicted that an earthquake on the west coast of New Zealand could result in very substantial waves hitting the NSW coast at the entrance to Sydney Harbour and measuring up to 3m at The Rocks, which is located 7km from the coast[12]. Rising sea levels provide a slow onset hazard that will impact low-lying areas around the edges of Sydney Harbour, including the reclaimed land along the foreshore of the Rocks Precinct[13]. Building fires have also been a regular occurrence in The Rocks, as in any urban area, with houses, workshops and warehouses all affected.

10. Vulnerabilities, sensitivities and risks to heritage values

The built heritage in The Rocks precinct is vulnerable to damage during a severe hailstorm through the susceptibility of its slate roofs to large hail damage, the tall chimneys to lightning strike and the below ground basements and enclosed areas to flooding. This is the case for several of the heritage attributes including Campbell's Stores, Unwin's Stores and Cadman's Cottage. The risk of damage is increased for Campbell's Stores by its location on low lying reclaimed land that is vulnerable to storm surge, particularly at high tide, and its location adjacent to a floodway. Cadman's cottage is at high risk because of its location in a flood storage area[14]. The poor condition of some of the buildings, lack of maintenance of gutters and drains and poor management practices of tenants add to the risk of damage to the heritage fabric[15].

Many of the buildings in The Rocks are vulnerable to earthquake due to their unreinforced block masonry construction. Although some of the buildings have been strengthened in recent years when conservation works have been carried out, many have not and are at risk of collapse. Of particular concern are the tall power station chimney that stands high above the precinct and the buildings that are in poor condition, such as Campbell's Stores, which is suffering extensive deterioration from salt attack and is in desperate need of repointing. Adding to the risks, when considering safe evacuation of people and access to The Rocks by emergency services are the narrow laneways and stairways that connect the low ground to the high as these are likely to be blocked by fallen debris, the impenetrable high rock faces and other barriers that surround the precinct and limit egress from the area, and the elevated roadways and railway that enclose the area, which, if they fall, will block all exits. If the sea wall collapses, the risks to archaeological sites located within the reclaimed land along the foreshore and the buildings located on this land will also be increased.

Considering the density of development within The Rocks, the loss of heritage values (historic, aesthetic, architectural, economic and social) will be high, not only as a result of building collapse, but also fire. The use of automatic alarms and sprinkler systems as fire mitigation measures was recorded as early as 1928 in The Rocks in the case of the Government Printing Office fire in Campbell's Stores[16]. Most buildings in The Rocks precinct have been upgraded to meet modern building codes and thus include fire rated construction, compartmentalization, fire isolated stairs and exits, as well as a full suite of fire warning and suppression systems. However, in the event of earthquake, many of these may not function as intended. Although the alarm systems are designed to operate on backup batteries and will notify NSW Fire and Rescue located just outside the precinct at Millers Point, water pipes may be broken preventing the activation of sprinklers and hydrants, and failure of the masonry walls will compromise the fire barriers that exist between the buildings as well as prevent access to the site by the fire brigade. Adding to the risk is the potential rupture of gas pipes, damage to electrical wiring and disturbance of cooking facilities in the many kitchens located throughout the precinct. Cadman's Cottage, although separated from other buildings within the precinct, is particularly vulnerable due to its timber shingled roof, which is surrounded by trees. Also at risk are the collections stored within the buildings, including historical records, archives, artwork and artifacts.

Safe evacuation of the area is complicated by the need to guide large crowds of visitors, both local

and international, out of the area, particularly when there are special events occurring within the precinct and market stalls may be obstructing the main evacuation routes of George and Argyle Streets (Fig. 11).

Fig. 11 Food markets in Argyle Street

11. Mitigation strategies

Mitigation strategies that may be implemented by SHFA (as owner of the properties and manager of the precinct as a whole) to reduce the risks to heritage fabric and values associated with the onset of a severe hailstorm should include:

- Installing lightning protection to vulnerable structures where this does not already exist;
- Ensuring that buildings are made watertight by undertaking essential roof and drainage repairs;
- Redirecting surface water away from buildings and low lying areas around buildings;
- Improving drainage systems from low lying areas;
- Educating tenants on the maintenance of gutters and drains, identifying the potential losses if they are not maintained; and
- Inspecting the buildings and drainage systems to ensure that the tenants are meeting their maintenance obligations as set out in their lease agreements.

Mitigation strategies to reduce the risks associated with earthquake and fire should include:

- Providing seismic upgrades to buildings that have not been upgraded to date, prioritizing buildings that are at greatest risk or pose the greatest danger;
- Ensuring that all fire systems are well maintained by requiring annual testing and certification;
- Ensuring that all kitchen and outdoor cooking facilities have fire extinguishers on hand and that tenants are trained in their use;
- Ensuring that trees do not overhang the shingled roof of Cadman's Cottage and providing an external water shield to protect the building;
- Providing training to disaster management wardens and first aid officers;
- Providing a secondary water supply within or in close proximity to the precinct. This would need to be coordinated with Sydney Water and may include provision of a secondary hydrant or pump system that uses water from the harbour if necessary;
- Providing appropriate strengthening to the sea wall to ensure structural stability; and
- Investigating the seismic capacity of the surrounding elevated roadways and railway, providing strengthening if required. This would need to be undertaken by Roads and Maritime Services.

12. Preparation

In preparing for a potential disaster, SHFA needs to engage with the local community, tenants, business owners, the City of Sydney, disaster response agencies (NSW Fire and Rescue, NSW Police, NSW State Emergency Services and NSW Ambulance) and service providers (water, gas, electricity) in formulation of an integrated Disaster Risk Management Plan (DRMP) for the precinct as a whole. Discussions should identify potential issues and appropriate and coordinated responses that accommodate the protection of the heritage values of the precinct throughout all stages of the disaster risk management process as well as other interests.

Inviting key people to visit and experience The Rocks on an informal basis should help to develop greater appreciation of the place and understanding of the potential loss to the community if the place and its heritage values were to be destroyed. Discussions with local business owners regarding the loss of both heritage and economic values should help to promote their maintenance of the properties they occupy as well as harness their involvement in the development of risk mitigation strategies. Local residents, including parents with small children, the elderly and disabled, should also be included in collaborative workshops that explore mitigation strategies for protecting homes, safe evacuation from the area and involvement in the recovery process following disaster.

Undertaking a coordinated disaster evacuation drill throughout the heritage precinct annually, that includes residents, business tenants, visitors and the emergency response services, will be essential to ensuring that locals are all aware of what they need to do, and for testing how visitors, unfamiliar with the layout of the precinct, can be safely evacuated. Different procedures for different disaster scenarios should be explored and tested. For example, in the case of tsunami, the evacuation would need to be to high ground on Observatory Hill, whereas in the case of earthquake, due to the danger of falling bridges over the evacuation routes, it may be safer for people to stay within the precinct, gathered at designated assembly points to await evacuation by boat.

Within SHFA, teams need to be established that can oversee the development and implementation of the DRMP in preparation for disaster as well as during the response and recovery phases. Good records of the heritage attributes within the precinct, in the form of surveys, inventories, photographs and measured drawings, stored in safe locations on and off site, will be essential to a well-organized recovery and reconstruction.

13. Emergency Response

In Australia the disaster response can be swift, with all debris, including the physical remains of our cultural and built heritage, being cleared away to make room for reconstruction and a fresh start. The resulting disconnection between the people and the place that was once familiar and important to them can contribute further to the grieving and sense of loss.

It is important that the SHFA teams are prepared well in advance of any disaster occurring, with protocols and procedures clearly identified and rehearsed, taking into consideration the protocols and procedures for disaster response set out in the Emergency Plans for the city[17]. Coordination with the emergency services and the local council, through the Senior Emergency Coordinator is essential.

14. Recovery and Reconstruction

As soon as possible after the initial emergency response, it is important that Damage Assessment and Artifacts Rescue teams are ready to act, to secure the affected sites and assess the damage. A team comprising at minimum a structural engineer, conservation architect, builder or carpenter and archaeologist will need to carry out the following tasks as quickly as possible:

- Secure the sites
- Undertake rapid assessment of the damage
- Stabilize any unstable structures
- Rescue, inventory, transport and store artifacts
- Remove building debris from the streets

- Store the salvaged materials, preferably on site
- Undertake site and building surveys
- Prepare preliminary budgets for insurance claims or funding applications
- Investigate causes of failures
- Determine goals and priorities for reconstruction

Officers will be required to brief the media and liaise with members of the local community (both residents and commercial tenants).
Whereas professional and local community volunteers may assist in the initial response, the medium and long term recovery and reconstruction phases will involve considerable input from local and state authorities, as well as professional consultants. Emphasis will need to be placed on planning for the future in collaboration with the local community, looking for ways to 'build back better' with sustainable and resilient solutions, but without compromising heritage values, and prioritizing works to re-establish business and attract people back to the site, as well as re-house residents.

15. Where to from here ?

To date the DRMP for The Rocks is only conceptual, as there has been no direct input from SHFA or the various other stakeholders that should be involved in its formulation, development, adoption and implementation. The first step would therefore be to get them involved as they will experience loss when disaster falls, and likewise, they will benefit from being well prepared.
Secondly, this DRMP has not been developed in consultation with the City of Sydney, which would have an important planning and coordination role during and following an emergency, nor the NSW State Government, which would also have considerable input into planning and funding the recovery. The heritage of The Rocks needs to be taken into consideration in their response and planning processes. Thus, both levels of government must be included in discussions regarding the development and implementation of the DRMP.
Thirdly, it will be important to integrate heritage into the local Emergency Plans for the City of Sydney, including the various sub-plans for the different types of disaster. Unless this occurs and the people involved in the disaster response and recovery sector are on board, it will be difficult to fully implement the DRMP. There will be other priorities to be addressed, which are seen as far more urgent and which may override or contradict the retention and conservation of The Rocks and its heritage values. It will be important that at all levels there is an awareness of the important role that heritage can play in cohering communities in times of crisis when all may appear lost. Heritage provides a positive connection between the past, present and future, strengthens identity and can contribute to a psychological safety net to improve recovery.
Fourthly, this case study addresses issues raised in an historic precinct that is majority owned and managed by government. In other areas of the city and other parts of Australia, our heritage is primarily located within the private sector. Thus, strategies must be developed for the adoption of disaster risk management planning for cultural heritage within the private sector, possibly through public-private partnerships. Even though government may be responsible for infrastructure, property owners are responsible for the management, care and protection of their properties.
Given the risks associated with our unpredictable and harsh climate and geomorphological conditions, combined with our occupation along the coastal fringe, disaster risk management planning for our most historic city needs to be considered as a vital and integral part of building our resilience for the future.

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2.3 Disaster Risk Management for the Historic for San Antonio del Cerro de Oro de Zaruma

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1. Introduction

The city of Zaruma is located at the south of the country and is part of the province of El Oro in the western Cordillera of the Andes; it is characterized by the irregularity of its geography and the steep slopes on which the city stands.

This city has a total of 9281 inhabitants distributed in the two zones, 3549 in the first order and 5732 in the buffer zone. About 24% of inhabitants in the region (canton) live in extreme poverty.

With an average temperature of 18 ° C to 24 ° C a humid subtropical climate predominates. The city is visited annually by approximately 10,500 domestic and 1500 international visitors.

The first human settlements of Zaruma can be traced back to the era of 1500-500 B.C., and their rich and diverse cultural expressions in archeological sites like Guayquichuma, Chepel, Payama, Trencilla and San Antonio located in various natural settings are a testament to the creativity and activities of previous inhabitants. It is also easy to find petroglyphs along the riverbanks and on mountain peaks.

2. Main attributes

The core centre of the city has been listed as a potential world heritage site on the indicative list of the World Heritage Centre since 1998, although a final dossier for the candidature has not been prepared yet.

The historical city center has the following main attributes:

Linking between the city and landscape

One of the main features is the natural landscape that mixes with the city so that it seems that the wild and natural vegetation acts as courtyards and gardens of the houses.

The immediate environment enters the buildings with different species of ornamental and medicinal plants and the distant landscape becomes the scenery enjoyed from the windows of the rooms of the traditional houses.

Vocational and mining history of the town

Gold mining activities were occurring in Zaruma even before the Spanish conquest and the Incan Empire. In fact, that the precious material would not only provide a name to the province where the city is located, but it would be a major factor in the city's development process.

Even until today, mining activities are part of everyday life, making it impossible to disassociate Zaruma with the golden glow of that substance.

Its importance not only remains at the local level but also on the regional level, with trade routes opened up with the other populated centers in the south like Cuenca and Loja. At the interregional level, the gold of Zaruma became the currency required by the merchants transporting imported products related to mining?tools, iron and mercury?thus fomenting trade between the Audiencia of Quito and Lima.

Traditional architecture

Responding to the climate and geography of the area, local architecture in has developed in a distinctive manner using local natural materials like wood (black guayacan, cedar, etc.). This architecture influenced construction in the area and still stands in the center of Zaruma where a

few examples of wooden structures are challenging topography and time.
According to the latest national inventory, there are 209 properties, of which 90% are housing. Of the aforementioned total, only 9% are in good condition, 65% are in fair condition and 26% are rated as in poor condition.

3. Natural Disasters

According to local evidence, this area of the province of El Oro is prone to landslides and fires.
Generally, the city has suffered from heavy rains and landslides. Data has been collected since 2007 showing annual disasters resulting in the loss of housing, road collapse and deterioration to the slopes and therefore the visual form of the city. Since 2013 landslides have been more frequent and in 2014 there have been four major landslides in the canton already.
The average annual rainfall is between 2000 and 4000 mm, and there are two well-defined seasons: the rainy season from January to April, and the dry season from June to December.
Geologically, this zone belongs to a volcanic-sedimentary series that is strongly mineralized with metallic sulfurs, whose relief is abrupt, with sharp, long and asymmetrical peaks. The highest parts of the area are occupied by igneous terrain from the cretaceous or tertiary eras.

4. Risk Analysis

An analysis of the existing situation has been done but while the field of risk management offers assorted diagnoses, maps, and contingency plans, none of them take cultural heritage into account. For the most part, in this area, there are assorted incomplete diagnoses that do not provide complete plans for mitigation of risk in the area
Most of the information found is partial or general information such as in the spatial development plan or cantonal tourism plans and even at the level of the dossier for World Heritage site candidacy there is only superficial information on risk management and this fails to link up with management plans.
The latest diagnoses made by the university UTPL, the risk of fire or arson is not addressed.
It is worth mentioning that there is an organization comprising local institutions chaired by the mayor and with the collaboration of the following agencies: GAD Zaruma (the municipality), the Fire Department, the municipal social affairs committee (Patronato Municipal), Zaruma Hospital, the civil service, Comisaría Nacional, National Police and Grupo de Caballeriía Blindada Febres Cordero
In addition to the seven working groups proposed by the National Secretary of Risk Management (Water supply, Health and Sanitation, Infrastructure, Integral care for population, Security, Productivity and Education, Environment and Cultural Heritage) for all communities, locally, more areas of work fot disaster mitigation have been defined including: Shelter and Evacuation; Food and Water; Economics and Public Communication.
Despite the apparent preparation, the city conducts no periodic drills, nor have the contingency plans been widely publicized.
There is a weak linkage between the national and local office of the national risk authority (COE) and few or no activities have been established by the various working groups of the COE which relate to the subject of cultural heritage.

5. Scenario

In the period from January to April, there were strong and constant rains, which caused earth movement in the downtown area. The landslide carried away what was in its path and worsened the situation by hitting the foundations of the houses which have been constructed with little or no technically resistant construction materials. For this reason, when a home plummets, it is like a domino effect, pushing the neighboring house and so all the houses on the block fall, causing blockages in the streets that prevent the evacuation of the people.
Additionally, the poor condition of the electrical wiring generates a short-circuit and a fire that quickly consumes the wooden structures and threatens to destroy the nearby properties.

Landslides also caused blockage of the only road to access to the city, when a water pipe broke and water distribution was affected. Although there are two secondary roads, they aren't in good condition and couldn't be used to get help to the cut off towns.
Due to mining, there are voids underneath the lower levels which have on occasion resulted in collapses that destroy properties. This is the result of the poor condition of many properties and because of the replacement of basement structure. This has led to the loss of many properties.
Trash and debris from constructions block also possible evacuations routes, leaving people with no possibility to get the designated safety spots.

6. Vision of DRM and Statement of Goal

Zaruma will be an example of a historical city that has learned to live with disasters due to its preparation and single management system in a country that takes cultural heritage into account in its planning.
The DRM seeks to raise awareness of the importance of the protection of cultural heritage in risk management, considering the significance and support that traditional knowledge can make before, during and after a disaster.

7. Partners and stakeholders identification

The possible and proposed partners and stakeholders are organized at international, national and local levels as follows:

International
ICOMOS, ICORP, World Heritage Centre, NGOs

National
ICOMOS ECUADOR, Secretaria Nacional de Gestión de Riesgo (COE), ARCOM [the Mining Regulatory body], Instituto Nacional de Patrimonio Cultural (INPC) [National Cultural Heritage Institute], Universities.

Local
Municipio de Zaruma [Municipality of Zaruma], Unidad de Gestion del riesgo [Risk Management Unit], COE Zona 7, BIRA, Fire Department, Municipal Social Affairs Committee, Hospital Zaruma, Civil Service, and Grupo de Caballeriía Blindada Febres Cordero.

8. Mitigation measurements

To define the measures to be taken to mitigate risk, it is necessary to consider the three themes, at the strategic, the tactical and the operational level.

Short Term
Revision of the scope of the risk unit and its human resources needs.
Inclusion of the risk awareness within the cultural heritage programme for schools, artisan groups and miners association.
Implementation of regular drills.
Memory as a tool to create awareness of a fire protection system.
Guidelines for maintenance of heritage wooden buildings. ie, non-inflammable material, material change in structures.
Regulation for new electric wiring.

Medium Term
Revision of the zoning and maximum allowed construction level.
Revision of plans and maps to include cultural heritage

Reforestation based on the identification of native and invasive plant.
Maintenance of roads, especially secondary access especially JAN-APRIL
Restoration and reinforcement of the schools identified as shelters.

Long Term
Structural reinforcement of side walls for evacuation paths.
Back up water supply system.

9. Emergency Preparedness and Response

In case of a disaster, the city will have means to alert the public. This will generally be through speakers located in churches and schools and an alert system through cell phones.
The city will complete the placement of signage on evacuation routes and safe sites that include emergency kits with reflective vests that allow group leaders and evacuations managers to be identified.
The main risk unit or command centre will be located in the Casa del Herrero, where the Risk Unit of the municipality works but a second risk command centre needs to be considered out of town due to the difficulty of access.
Emergency equipment for fire control should be installed at strategic locations, mainly in places with easily accessibility and areas close to the main buildings and more vulnerable to fire (Fig 1).
Evacuation routes have been proposed by area, defining the corresponding quarters of the areas, suitable routes and corresponding shelters and refuges as detailed in the attached Table 1.

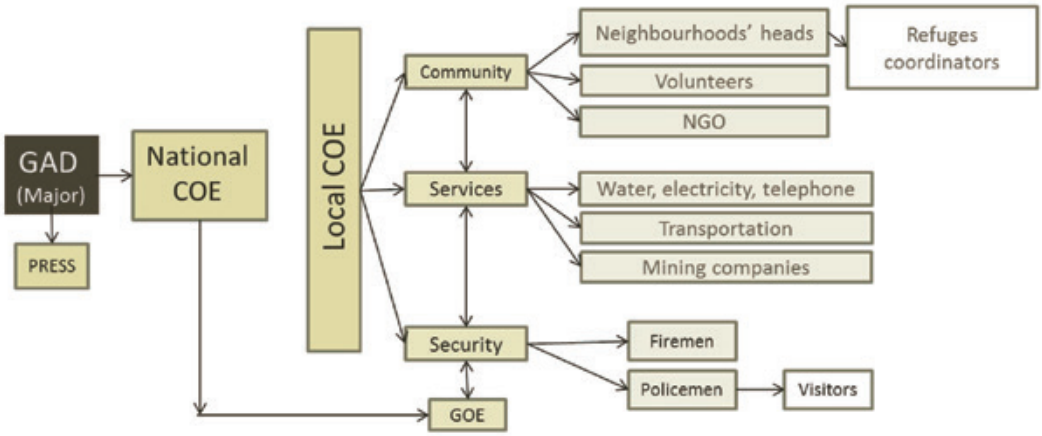

Fig. 1 The emergency and preparedness and response chart for the city

Table 1

Area	Neighbourhoods	Route	Shelter and refuge
North	El Calvario and La Alborada	Damián Meneses, La Colina and Pichincha streets.	La Inmaculada School
	24 de Mayo and Tanques de Agua	La Colina, Pichincha, 10 de Agosto, Bolívar, Sucre and Av. Honorato Márquez Streets	Nacional 26 de Noviembre School
	Cuatro Caminos and Toscón Blanco	San Francisco and Damián Meneses streets.	Gabriela Mistral School
Centre	Rocafuerte	Rocafuerte and Justino Cornejo streets.	Unidad Educativa San Juan Bosco School
	El Oro Avenue	El Oro Avenue	Centro Escolar Guillermo Maldonado Valencia School
South	Gonzalo Pizarro	Gonzalo Pizarro and Dr. Marcelo Zambrano streets	Sultana de El Oro School
West	El Sexmo	El Minero, Cerro de Oro and Damián Meneses streets.	Gabriela Mistral School

10. Recovery plan

The plan must consider that certain activities will not stop in the short term but will serve as feedback for the mitigation and planning phases in the future.

Within the activities to be done, it is very important to consider fundraising, damage assessment, revision of existent codes and regulations, among other activities. The recovery plan is proposed to be accomplished via four focus areas.

①Utilities
②People
③Infrastructure
④Cultural Heritage

11. Conclusion

The challenges for implementing a risk mitigation plan in this area are many, in particular, it is necessary to work on the awareness, given the unfulfilled needs and the small annual budgets that result in little being done in this field.

It is for this reason that small projects need to be started. The main objective is to raise awareness and include the topic of risk management among the daily activities.

And these small activities will help to strengthen local capacity to monitor the activities of the risk management plan with catalyst projects that will always be linked to the preparation of the city for post-disaster times.

Activities designed as part of the DRM will not have just a single purpose but will be designed to meet other demands of the population, including recreational and leisure purposes.

It is clear that at some point, the participation of the authorities at a local and national level will be mandatory in order to achieve the goals of this DRM to include the legal framework, the policies, preventive maintenance, planning and capacity building.

12. Pilot Project

The title of the project is “Don’t be scared, be prepared!” and it has as its main objective to raise awareness of the importance of mitigating risk while collecting information through old photographs and documents.

It will gather information that may be useful for activities in the DRM plans, information that can lead us to previous practices and that could raise awareness of past events and disasters and also create a database with technical information if necessary for repair or reconstruction.

An exhibition of the material collected in areas assigned for shelters and safe areas identified in evacuation plans will be made.

The intention is to familiarize people with the spaces as everyday referents as playful interaction and not as areas associated with the disaster.

Further information will tell us the old methods of mitigation or disaster preparedness and ways of living with nature and mining in the area.

And, finally the documents will complement the existing database in the municipality and will enable us to convert the information into technical data to be used for future interventions.

The exhibitions will be held outdoors and in different formats, mainly exhibitions of small and medium format in shelters described in evacuation routes and spaces between buildings that would be retrofitted to consolidate them as fast escape routes; and large format prints in areas where previous disasters have happened and even with the passage of time have not fully recovered, for example, the hill of El Calvario where the imprint of a landslide remains and the vacant lot near the main park where a house was destroyed by fire.

In this way the project will raise people’s awareness of risk prevention and connect them to areas that will be used in the future as evacuation routes and safety spots.

2.4 Formulating Disaster Risk Management Plan of a part of Historic Cairo

Abdelhamid SALAH EL-SHARIEF
Chairman of the Egyptian Heritage Rescue Foundation (EHRF), Egypt

1. Introduction to the city (Fig. 1)

During just a short walking through the streets of Historic Cairo you can go from a period to another with its traditions, crafts, habits and most parts of it you can still recognize the fabric of the old city (Fig. 2).

The property of Historic Cairo was inscribed on the World Heritage List in 1979[1)], recognizing the "absolutely unquestionable historical, archaeological and urbanistic importance" of the historic city of Cairo, based on the following criteria.

Several of the great monuments of Cairo are incontestable masterpieces.

The center of Cairo groups numerous streets and old dwellings and thus maintains, in the heart of the traditional urban fabric, forms of human settlement which go back to the middle Ages.

The historic center of Cairo constitutes an impressive material witness to the international importance, on the political, strategic, intellectual and commercial level, of the city during the medieval period.

Fig. 1 C. URCH project

Fig. 2 C. Save Cairo Initiative

2. Formulating Disaster Risk Management study of the Historic City

Introduction

There is no doubt today that we need to formulate DRM plan for each historic city to set a list of intervention priorities specially that each country is suffering because the lack of funding. And by setting up DRM plan we can find the right strategy from short to long term based on the risks that identified by the plan and the available financial sources.

Understanding the hazards and the vulnerabilities of the Historic Cairo to find the common sources of risk and weakness between its districts, streets, buildings, different attribute and even the surrounding area will not be an easy task unless a detailed investigation should be done in each zone of the city with understanding the community of each zone and its need. This is why the study is focus on one pilot zone of the historic city (Fig. 3).

The vision of the study

To conserve the identity of the city and to find the potential factors to make it resilience

The objective of the study

- Finding a sustainable plan to reduce the risks
- Matching the needs of the DRM plan with the surrounding communities.
- Raise the awareness of the need for DRM of Cultural Heritage among the stakeholders
- Conserving the identity of the city
- Identifying the hazards which can cause risks to the city
- Setting a list of priorities for the intervention
- Assessing the values of the city
- Finding the relation between the hazards and the vulnerabilities of the city
- Listing the roles of the involved stakeholders

Fig. 3 C. URHC Project

3. Potential Hazards:

The study is focusing just on the main hazards that can cause major loss of the values of the city and each will be clarified with a chart to find out the relation between each hazard and site`s vulnerabilities.

4. Earthquake (Fig. 4)

Cairo faces earthquakes in a significant magnitude and frequency, it was reported historically that some monuments have collapsed during historical earthquakes, the last significant earthquake stroke Cairo in 1992 claiming lives of 500 people in Cairo, most of them in Historical areas due to large number of deteriorated buildings. Most monuments suffered different levels of destruction

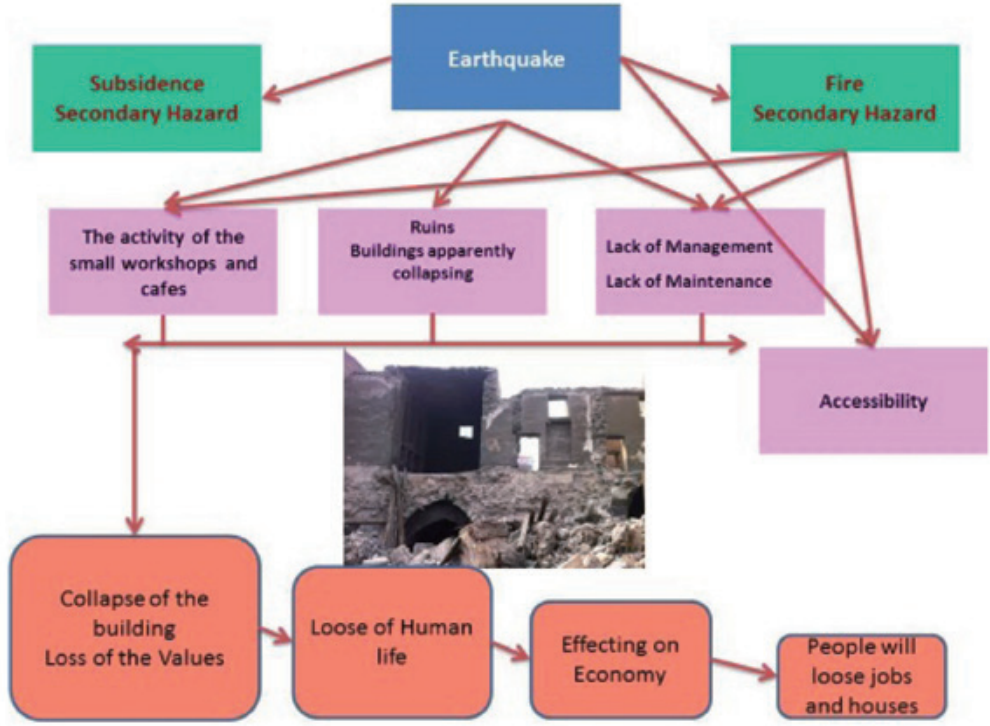

Fig. 4 C. Author

5. Increasing subsurface water level (Fig. 5)

The high dam caused general increase in ground water level in most of Nile valley, before the dam, Nile worked as a source of water during flood time and then acts as a drain for the rest of the year after its level subsides. In addition to other factors affecting its subsurface water, urban expansion of Cairo around the historical core caused extra inputs to the aquifer, garden irrigation and seepage from water and sanitation systems and informal areas with no sanitation systems all contribute to the subsurface water input.

Also we cannot ignore the lack of maintenance of the sanitation system (Fig. 6) to match the high population of the area as well as the workshop activities, which also another source of increasing the level of the subsurface water. As well as building the two lines of subway one of them going through the Historic Cairo which needed to inject the soil with material to isolate the water around the subway tunnels.

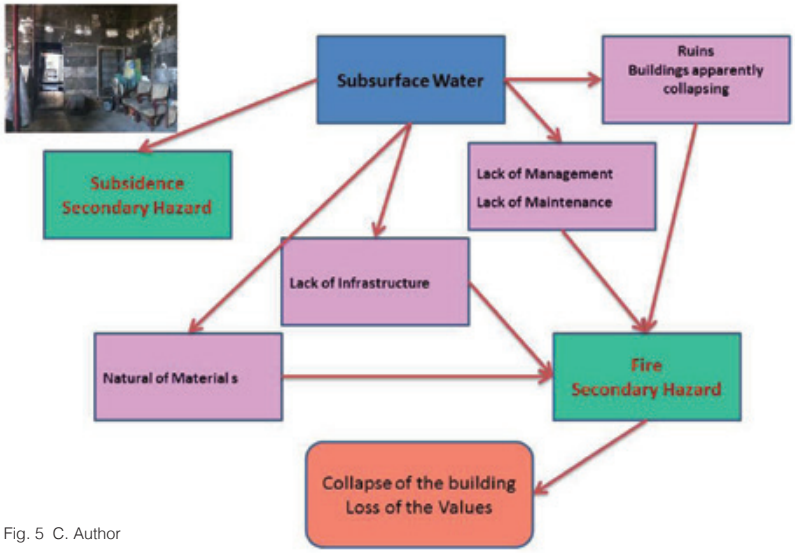

Fig. 5 C. Author

Fig. 6

6. Fire (Fig. 7)

Due to the vast amount of fire sources and fuels Fire is one of the most fatal threats to Historical Cairo as well we the lack of mitigation and preparedness measures of firefighting as well as the low accessibility for firefighting tracks (Fig. 8). In recent past some precious monuments was lost due to fire. Another reason is vacant Lands which are informally used as waste dumb, which may provide a high risk of catching Fire (Fig. 9), also compact urban Fabric with attached buildings that causes fast spread of fire from a building to another and what more is existence of illegal high rise buildings in such narrow streets that can't give access to firefighting vehicles, beside that the activity of some of the workshops that use natural gas and oxygen as source of fire to their activities.

In Historic Cairo people are leaving side by side in every part of the city, so they are facing the fire risk as well.

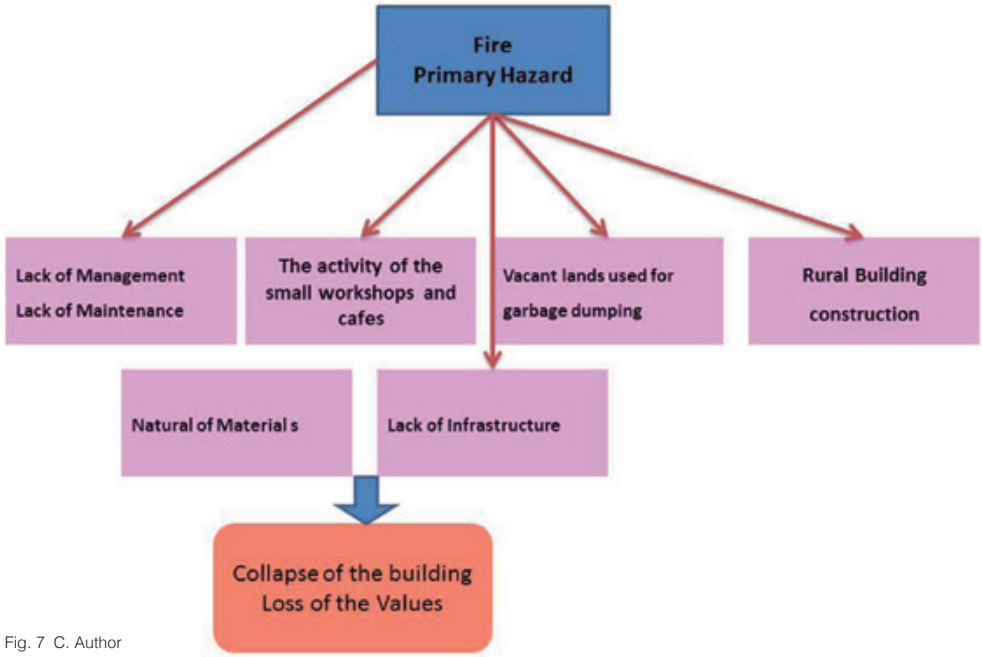

Fig. 7 C. Author

Fig. 8 C. T. Elmori

Fig. 9 C. Author

7. New Un-planned, Illegal construction (Fig. 10)

After the revolution of 25th of January 2011 and due to the absent of the security as we as the legal authorities that responsible of managing, protecting and securing the heritage properties in Egypt, many illegal buildings have built side by side with the archeological areas and sites, even more that it replaced them in some cases. Which cause much loss of many sites and decrease the value of the historical area.

Fig. 10 C. URHC project

8. Terrorist Attacks:

Many terrorist attacks have hit some parts of historic Cairo and as a last big one in 24th January 2014 was targeting the main police station of Cairo which is existing in front of the Museum of Islamic Art – (Fig. 11, 12) one of the most important museums in the world- and caused some damage to the building and many damages for the collections of the Museum.

Fig. 11 C. Author

Fig. 12 C. Author

9. Vulnerabilities of the site

By analyzing the hazards and studying its charts we find that each hazard can have major effect when it meets one or more vulnerabilities in the city. Sometimes a primary hazard due to hitting some vulnerability can cause secondary hazards and from here we have to realize the importance to identify the vulnerability in order to set up the DRM plan.

10. The mitigation plan

The Mitigation strategy should be set up based on the data collected in the risk assessment, the priorities of the endanger heritage and understanding the economic situation of the country. The strategy should be divided from short to long term by planning a sequence of preventive measures and studying the role as well as the capacity of each involved party.
First: Identifying the involved parties and clarify its responsibilities.

11. The involved parties

Some of the Vulnerabilities that the study brought it out

- The activity of the small workshops and cafes (Fig.13)
- Gas Cylinders storage
- Vacant lands used for garbage dumping
- Casting, welding or metal cutting workshops or similar workshops using fire
- Areas not accessible to firefighting vehicles or any emergency support
- high rise buildings (above 5 stories)
- Ruins (may contain biological hazards such as snakes or rats...)
- The conflict between the different authorities that control the Heritage in Egypt
- Buildings apparently collapsing (Fig.14)
- Buildings with excessive moister content
- Indoor water ponds (in basements or low level ground floors)
- Lack of Management for building and sites
- Lack of Maintenance in the level of sites and infrastructure
- Lack of community awareness
- Building are so close from each other (Fig. 15)
- Incorrect restoration
- Lack of security
- No building codes for building and infrastructure that fit with the need of historical cities.
- No plan for reusing of the buildings

Fig. 13 C. W.Abu-Bakr

Fig. 14 C. W.Abu-Bakr

Fig. 15 C. W.Abu-Bakr

12. Local parties

Involved party	Responsibility
Ministry of Antiquities	Responsible of listed Historical sites and the security inside it
Ministry of Cultural	occupying some of listed Historical buildings to provide activities inside those buildings
Ministry of Interior	The security of the surrounded area
Municipality	The infrastructure in the city and all the building that not listed
Ministry of Awkaf	Responsible most of Mosques and many other listed and historical buildings
Ministry of Defense	Responsible of the intervention in major disaster
NGOs	Some activity inside the sites and within the community
Community	Living around and inside the listed buildings in some cases

Beside the international involved parties such as UNESCO, ICCROM, ICOM and ICOMOS.

13. The mitigation measures (Fig. 16)

The mitigation strategy will be based on the involving of the stakeholders and as mentioned above that community is leaving side by side with the heritage there, the community will have the main involving as well as the active NGOs in the city.

The measures will start with advocating for national legal framework of disaster risk management plan, then setting up the priority procedures, renew the infrastructure, reducing the vulnerability of the sites and the attributes with sustainable management that come out with integrated maintenance phases, design and reuse Derelict spaces and building, the adaption of the workshop activity from unsecured to secured, maintenance of the roads and increase its accessibility, firefighting System workshops for the community especially those who are using fire sources in their activities, documentation of the sites and its collection, find and develop a database system for all the sites with its objects. This database should include enough historical information, conservation work, history of disaster that affected the area, retrofitting the existing building including listed and historical buildings as well as those building that exist in the buffer zone of each listed building.

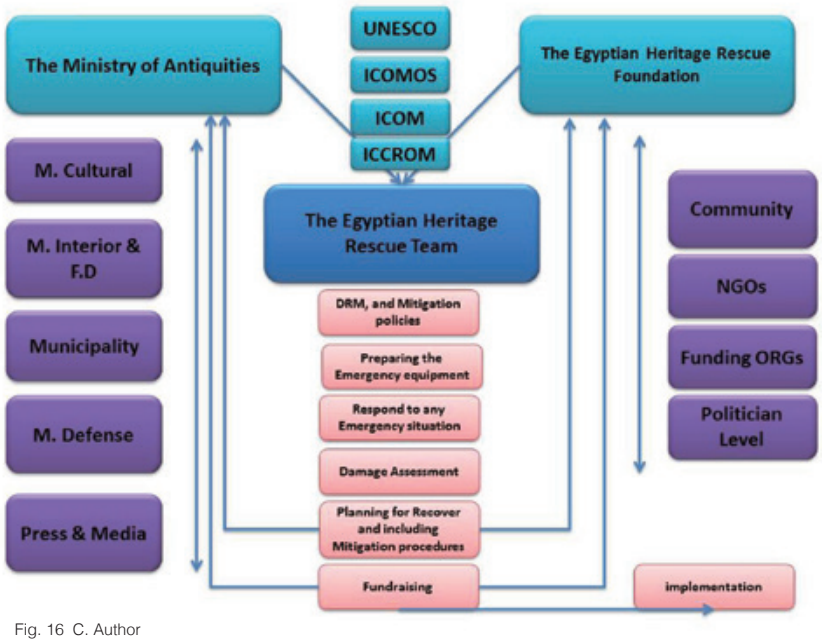

Fig. 16 C. Author

14. Emergency Respond and Preparedness plan (Fig. 17)

Training staff to act as Heritage Rescue Team is very important to stop any further damage for the Heritage and have the capability to intervene in any emergency situation can affect negative on heritage (Fig. 18). And to lead the following steps:

- Prepare the evacuation plans for persons , objects and heritage fragments
- Increase the capacity respond of emergency team, NGOs and the community
- Prepare and setting up the fire distinguishers equipment
- Develop emergency plans and adapt it according to the risk assessment
- Organize simulations for different scenarios with including every partners
- Setting up the contact list in Case of Emergency

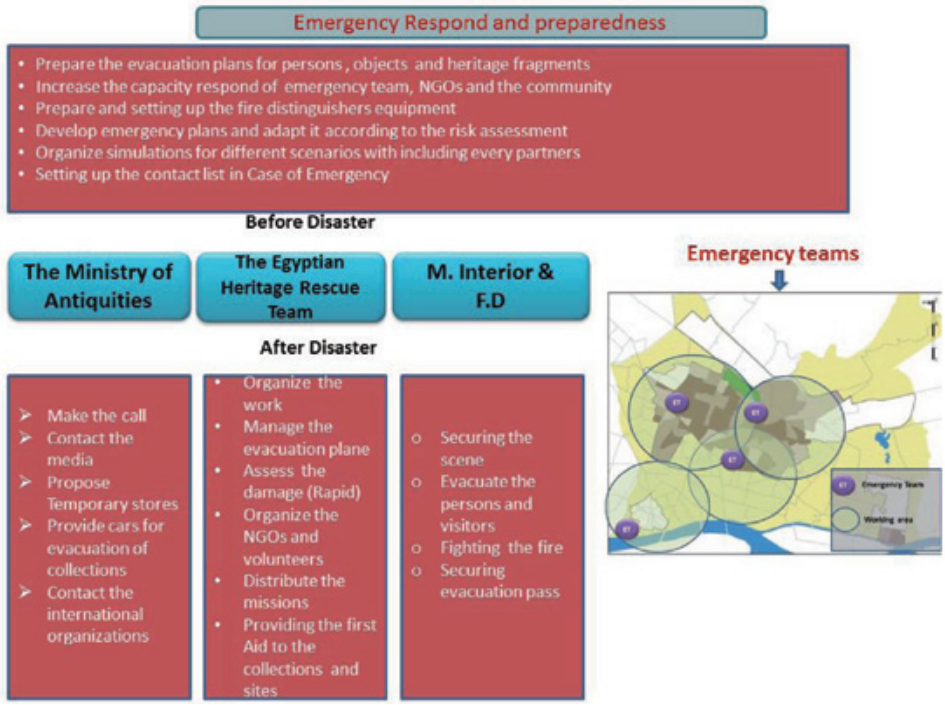

Fig. 17 C. Author

Fig. 18 C. Author

15. Recover plan (Fig. 19)

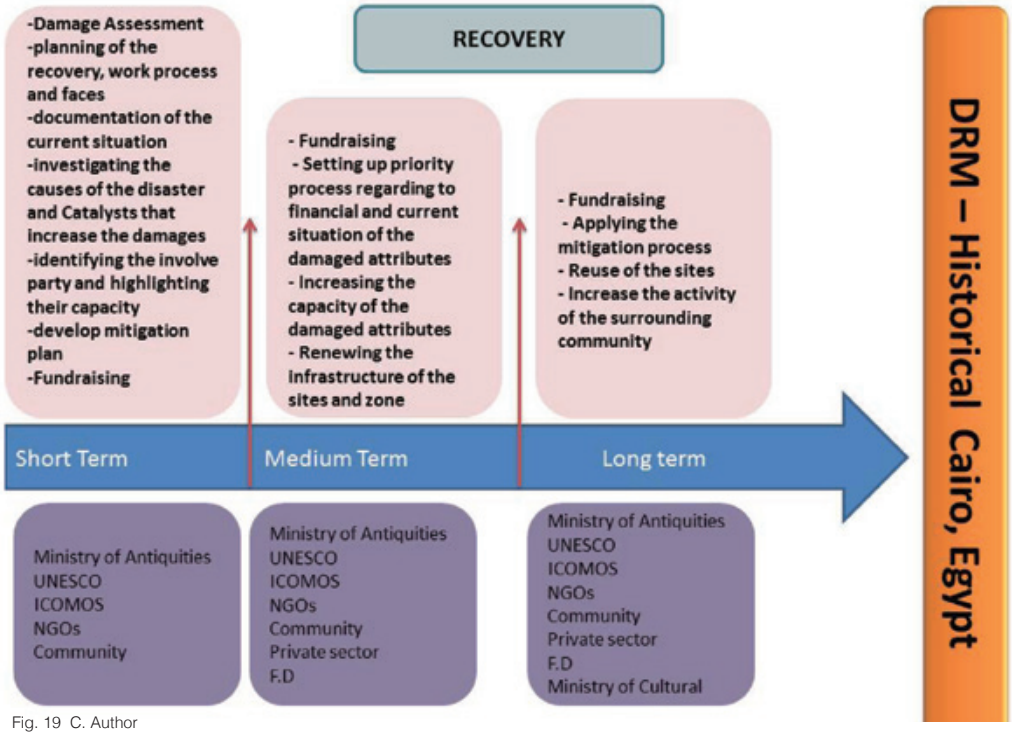

Fig. 19 C. Author

16. Conclusions

Formulating DRM plan should be a task start from policy level to reach the community level, distributing the responsibility between the involved stakeholders under a detailed DRM plan.
Existing of a developed database is needed with clear and documented information
A short term plan should start by increasing the awareness between the communities, reducing the vulnerability of the city with integrated conservation plan as well starting to develop reusing plan of the sites with activities that finding the link between the heritage and the community and by that solution NGOs can start to support the government to increase the fund to maintain the heritage.

Reference:

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2.5 Outline of a Disaster Risk Management Plan (DRM) of Historic Centre. Tegucigalpa, Honduras

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1. Introduction

Honduras is one of the most vulnerable countries to natural disasters in the Central American region. The Central District or better known as Tegucigalpa, the Capital city of the country is located in the central region, with approximately 1.3 million inhabitants. Choluteca River divides the city from north to south, in what is called the twins city of Tegucigalpa and Comayaguela. The river, its irregular topography, geological and hydrological conditions, informal and uncontrolled rapid growth and expansion are the principle agents that contribute for the city to be one of the most vulnerable areas of the country.

It was until 2011, during the elaboration of the Municipal Development Plan, when the words risk and hazards where taken in account, including a chapter for disaster risk management and an urban planning thought on reducing the risks and vulnerabilities of the city. Nevertheless this plan didn´t involve the protection of Cultural Heritage on the aspects of natural disaster risks.

2. Studied Area for drafting the DRM and its significant Attributes and Values

As most of Latin American cities, Tegucigalpa has the Spanish configuration, with many churches and plazas, surrounding them the local government buildings and houses of the political and high class. Besides it, in 1880 when Tegucigalpa became the Capital City, all the Central Government buildings where constructed and political and cultural activities regarding the country where held in the city. These, among many other are issues that give the city's Historic Centre cultural, tangible, movable and immovable attributes (Fig. 1).

In 1994 through agreement number 527, the central government declared the Historic Centre of the Central District as a National Monument.

The attributes of the Historic Centre carry values that can be grouped as follows (Fig. 2):

- Architectural Value: The churches and the city configuration in itself have the characteristics that tell the story of the Colonial time. The Historic Buildings such as the City Hall, the first hospital (know the Museum of National Identity), the National Post Office still in use, have architectural characteristics of the republican time. Vernacular buildings, most of them built during colonial time, whose material of construction mark a special time in history of Tegucigalpa.
- Religious and Social Values: Six of the seven churches in the Historic Centre are still in use. These buildings and the plazas in front of them are places for gathering. And the religious activities that are held during the year are signs of the cultural value these assets have.
- Educational and Historical value: Most of the governmental buildings are used as museums and/or libraries.

Many are the stakeholders that are involved in the protection of the attributes of the historic centre, among them can mentioned: ministry of culture, local government, community, artists, ministry of education, church, emergency response team, parliament.

Fig. 1 Location of Historic Centre of Tegucigalpa

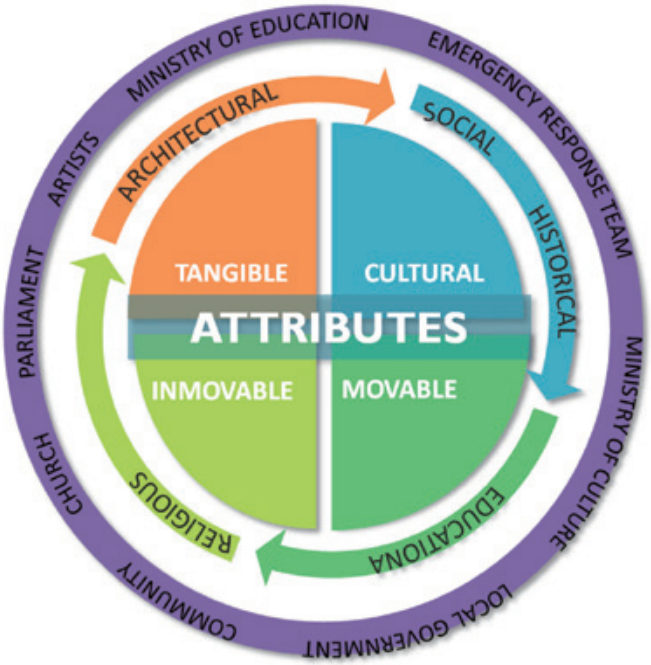

Fig. 2 Attributes, Values and Stake Holders

3. Hazards, Threats and Vulnerabilities

The lack of maintenance and poor state of conservation of many of the buildings make the attributes and values of this site vulnerable to any hazard. The potential hazards that may damage the site are hurricanes, heavy rainfall, landslides, fire and earthquakes. And a slow and silent threat is the illegal and informal urban developments along the river margins (Fig. 3).

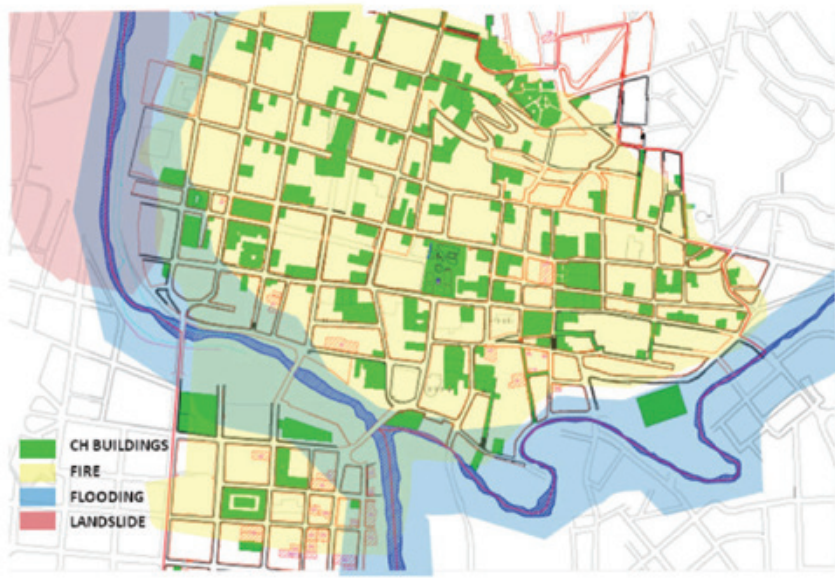

Fig. 3 Natural Hazard Risk Map

Heavy rainfall and flooding can weaken the buildings due to its material of construction (*adobe*- mud based brick). The rainfall can cause landslides, being the most threatening the Berrinche Hill that could destroy the buildings in the west part of the historic centre. Fire could destroy the roof and ceiling structures which are made out of wood, and the heavy tiles would come down damaging the adobe walls. Since there is no space between buildings if a fire starts it may spread through the whole block very easily due to the flammable materials of the roof. Buildings might collapse during an earthquake because of the none reinforced *adobe* structures and the cavity under the streets, due in part to the lack of maintenance of the old sewerage (immediate assessment about this has to be done). The informal constructions along the river in case of a flood will be destroyed and all the debris that the water brings will damage the historical buildings. Studies have indicated that without the constructions along the river, in a flash flood the water will cover more than 30% of the historic centre. The condition of these constructions along the river will aggravate the situation and at the same time make it difficult for the help to arrive to the place.

The potential negative impacts that the attributes of the site might have are among the most significant the loss of lives, loss of architectural value because of the destruction of buildings. The Social value will be affected, spaces that the site has as the churches, plazas, theatre will be loss. Historical and educational values will be decreased, because of the loss of data and collections from museums. Economical damage and decrease in tourism (Fig. 4).

Fig. 4 Cultural Heritage Buildings in the Historic Centre of Tegucigalpa

Scenario

A Hurricane arrived to the country, wind storms starts all over the territory. Heavy rainfall during three days in Tegucigalpa caused flash floods of Choluteca's river and tributaries. The swollen river overflows its banks, tearing down the entire neighborhood and bridges around the historic district. The rainfall also triggers massive landslides, close to the downtown area. Due to the landslides debris flowed into the river, forming a dam. The dam clogged the waters of the river and many of the low-lying areas of the Historic District were submerged; historic buildings located along the river were either completely destroyed or badly damaged. The massive landslide occurred during midnight so the staff of the museums and heritage buildings were not able to save any art work, document or sculpture.

4. Disaster Risk Mitigation Plan Draft

Due to the vulnerability of the city, the government developed a Disaster Risk Management Plan that protects in first place people and in a second instance the infrastructure. No cultural heritage protection is mentioned in this plan. That´s why the main goals for a construction of a DRM for Cultural Heritage is to create social awareness in the community, building owners, central and local government of the need to protect the cultural heritage from a disaster, and to Involve cultural heritage in the disaster risk management plan (sinager-copeco) existing in Honduras. Little steps have been done by joining the program of Resilient Cities and introducing into the DRM plan the Hyogo Framework.

Mitigation Strategies

The following chart shows the different strategies evaluated for the DRM draft for the historic centre of Tegucigalpa (Table 1).

Emergency Preparedness, Response and Recovery Plan

For the emergency preparedness, the most important issue is to have a team that would response effectively in any case. For this instance Tegucigalpa has an emergency response institution that works successfully in cases of natural disasters, but they don´t work in the protection of cultural Heritage. That is why besides the existing emergency response which is in this case external

Table 1

LEVEL	MITIGATION MEASURE	WHEN	WHO	HOW MUCH
STRATEGICAL	Introduce into the national disaster risk management system the protection of cultural heritage.	LONG TERM	LOCAL GOVERNMET, COPECO-CODEM, HISTORIC CENTRE OFFICE	LOW COST
	Creating social awareness of the hazard and threats the historic district has.	SHORT TERM	COMMUNITY, CULTURAL COMMITTES, LOCAL GOVERNMENT	MEDIUM COST
TACTICAL	Studies for the stabilization of the berrinche hill to avoid landslides (implementation of the techniques)	SHORT	NATIONAL AND INTERNATIONAL EXPERTS, NATIONAL GOVERNMET (INFRASTRUCTURE DEPARTMENT), LOCAL GOVERNMENT	HIGH
	Assess the buildings stability in case of earthquake and flood.	SHORT	CONSERVATORS, IHAH, GCH, ACADEMY	MEDIUM
	Apply techniques for the stabilization of the ch buildings	MEDIUM	NATIONAL AND INTERNATIONAL EXPERTS, NATIONAL GOVERNMET (INFRASTRUCTURE DEPARTMENT), LOCAL GOVERNMENT	HIGH
	Periodic maintenance of CH buildings.	SHORT	BUILDING MANAGERS AND OWNERS, LOCAL GOVERNMET, MINISTRY OF CULTURE, IHAH	MEDIUM
	Countermeasures for the river (cleaning, digging)	SHORT	LOCAL GOVERNMET	MEDIUM COST
OPERATIONAL	Review the national code for drm to introduce in them the protection for historic buildings.	MEDIUM	POLITICIANS (CULTURAL COMMITTE IN PARLIAMENT)	LOW COST
	Special regulation for construction on river banks.	SHORT	LOCAL GOVERNEMET, PLANIFICATION UNIT	LOW COST
	Define under the master plan for the historic district a green area along the river.	MEDIUM	LOCAL GOVERNEMENT, HISTORIC CENTRE OFFICE	LOW COST
	Special regulations for electrical systems.	SHORT	FIRE DEPARTMENT, LOCAL GOVERNMENT PALNIFICATION UNIT	LOW COST
	Community planning involving the people living in the informal settlements as human resource for the protection of the site.	SHORT /MEDIUM	COMMUNITY, LOCAL GOVERNMENT	MEDIUM COST

(national level) to the site, the stakeholders in the local level involved must work and be part of the team. The local stakeholders are Community Leader (patronatos), Heritage Buildings Managers, CODEL (Community emergency response team), Head chief of Historic Central District Office, and the external team CODEM (Local Government emergency response team), COPECO (Central Government emergency response team), Emergency response NGO´s, Fire Department and Police Department (Fig. 5).

Since the most threatening and usual hazards (flooding, heavy rainfall) can be predicted the emergency response team should start at the national level, nevertheless the local team must inform of any emergency that hasn´t been predicted (fire).

Since the Historic Centre has the Spanish colonial configuration it has many plazas that can work as evacuation areas in case of fire or flash flooding (Fig. 6).

As for recovery activities they can be grouped on immediate, short, medium term and those that have to be periodically revised. The first days are those for rescuing efforts, they involve specifically on trying to save lives. After this a general overview of the Cultural Heritage must be done by the direct stakeholders and assessment of damage of the buildings must be started. The first assessment will define the emergency treatment that has to be taken for the damaged buildings, to later on time after a defined recovery plan for the buildings and urban areas has been elaborated, start with the restoration works. The DRM plan for the site must be revised and modified depending on the lessons learned on the past disasters (Fig. 7).

Fig. 5 Flowchart of Emergency Team

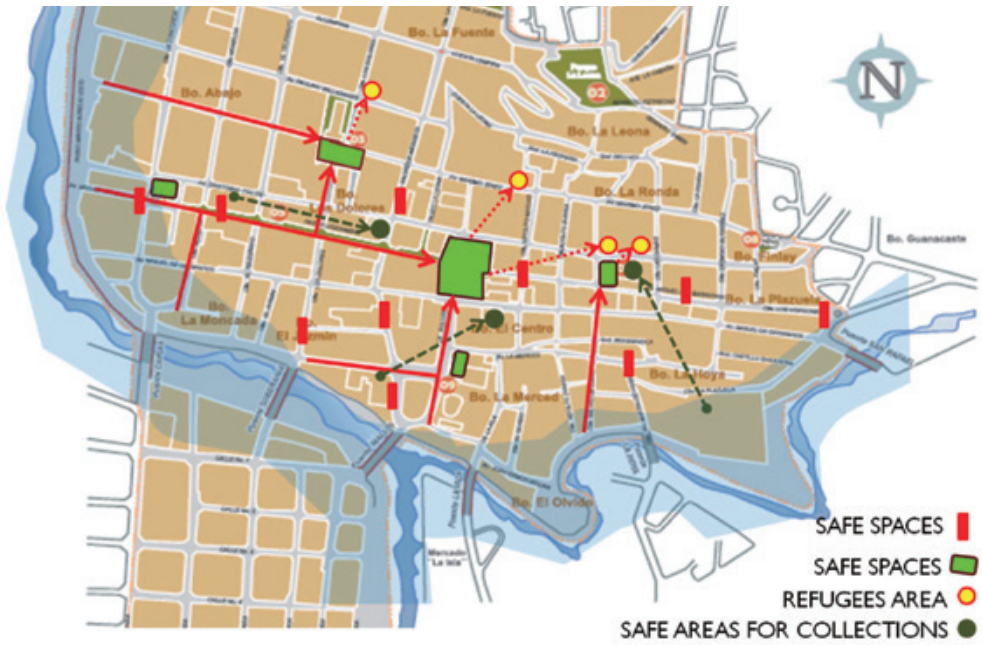

Fig. 6 Proposed Evacuation Routes Map

Fig. 7 Proposed Recovery Plan

5. Conclusions

Protection of cultural Heritage and risk management are two separate institutions that must be married for the formulation of a Disaster Risk Management of cultural Heritage in Tegucigalpa. The lack of articulation of these institutions makes it difficult to protect the attributes and values this site have. Writing down the draft for a DRM makes it easier to know the path we must follow to formulate the real DRM that will engage all the stakeholders involved in the protection of cultural heritage and the disaster risk management.

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3 Formulating Disaster Risk Management Plans of Heritage Sites

3.1 Cultural Heritage at Risk: Preparing a Disaster Risk Management Plan for the UNESCO World Heritage Property of Fatehpur Sikri, India

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1. Context

There is increasing unanimity among professionals and academics who engage with culture that the contemporary recognition of cultural heritage must shift from its traditional position as a rather niche discipline to gaining acceptance as a mainstream determinant of the design and development of the contemporary built environment. Indeed, the 2010 UN Summit on the Millennium Development Goals strongly articulated the pivotal role played by culture towards the realization of sustainable development goals. If the global community aims to realize the notion of sustainable development in entirety, it is imperative that the immunity of the cultural ecosystem, a Throsby-ian construct, be bolstered against potential risks just as the environmental ecosystem has been shielded from potential risks that could undermine its existence. This entails that heritage and the risks that threaten its wellbeing be allowed to occupy a more centre stage position for an engaging dialogue between them as opposed to the conventional practice of regarding the two as disparate disciplines, detached from one another.

Absence of an interface between culture and potential risks it faces and their management is an issue that persists across nations in varying degrees of complexity. In the Indian context, on the one hand, there is little awareness of culture's value as an asset to be safeguarded for posterity, on the other, there is not only lack of awareness about the management of risk to culture, but also lack of representation of culture in disaster management initiatives in general. This scenario poses a threat to the vast corpus of cultural heritage in India thereby underscoring the need for examining culture from a risk lens. In an attempt to bridge the gap between heritage and risk, this Paper proposes a Disaster Risk Management Plan (henceforth DRM Plan) for the UNESCO World Heritage Site of Fatehpur Sikri in India. The DRM Plan is being made for the religious and spiritual precinct of Fatehpur Sikri and aims to demonstrate that management of risk enhances the value of the cultural resource and safeguards it for posterity.

2. Fatehpur Sikri: Overview

Fatehpur Sikri, located in Agra District of the state of Uttar Pradesh in north India, is a 16th century city built by one of the most illustrious rulers of the Mughal Dynasty, *Badshah* (Emperor) Akbar (1556-1605). Envisaged as a *Badshahi Shahar* (imperial capital), the city's longevity as a Mughal capital was rather short, only about a decade, in comparison to other Mughal capitals, Agra, Delhi and Lahore. Its patron's reverence for the highly venerated *Sufi* saint, Sheikh Salim Chishti, who resided at the site, and whose blessing resulted in the birth of an heir to the Mughal throne, caused *Badshah* Akbar to raise a capital city in 1571 under his own supervision (Fig.1). As a capital city, Fatehpur Sikri, was equipped with all the necessary spatial configurations required for the functioning of a grand Mughal court with the imperial complex occupying the most prominent site on the top of a rocky sandstone ridge and overlooking an artificial lake, all contained within a walled enclosure with a number of gates. The imperial complex broadly comprised a spatial ensemble with spaces for governance and residence and a religious and spiritual precinct, the latter centered on the *Jami Masjid* (Friday mosque) and the *Dargah* (place of interment) of Sheikh Salim Chishti. Dispensed around it were the residences of the city's nobles and other residents. The city was a tangible embodiment of *Badshah* Akbar's egalitarian views with built forms arranged around a series of open courts, terraces and gardens, exhibiting architectural influences culled from all parts of the Mughal domain, whose diversity was underpinned by homogeneity induced

by the building material, red sandstone that was locally quarried (Fig.2). Even as the walled city did not last as a Mughal capital for more than a decade, Fatehpur Sikri was comparable to other Mughal capitals in terms of architectural grandness that underscored most Mughal building ventures.

Fig. 1 Fatehpur Sikri: Overview of the capital city Courtesy: Author

Fig. 2 Fatehpur Sikri: Imperial Palace complex Courtesy: Author

3. Fatehpur Sikri: UNESCO World Heritage Site

Fatehpur Sikri was inscribed as a UNESCO World Heritage Site in 1986 under its operational guidelines via Criteria (ii), (iii) and (iv). The imperial complex, with both the religious and secular precincts, forms the core of the heritage site and has 93 monuments that are protected by Government of India's nodal official organization for conservation of cultural heritage, Archaeological Survey of India (henceforth ASI). Even as ASI is the official custodian of the site and is responsible for its conservation, the religious and spiritual precinct is under the care of the Waqf Board. The site lies in the Taj Trapezium Zone, an area of 10,400 Sq. Km. that bans polluting industries. Further, the site has a well defined core area where construction is prohibited up to 100.0 M. radius from the protected limit and a buffer area where construction is regulated up to 200.0 M. radius from the prohibited limit (Fig.3). Furthermore, an extension of the buffer area is planned under the Fatehpur Sikri Master Plan. Fatehpur Sikri is a very popular tourist site receiving a large number of visitors, both domestic and foreign, with the numbers for the year 2012-13 being 499,074 and 219,882 respectively as per ASI's ticket collection records. Currently, no site management plan has been prepared for the site, although the process is underway. Likewise no DRM Plan for the site currently exists.

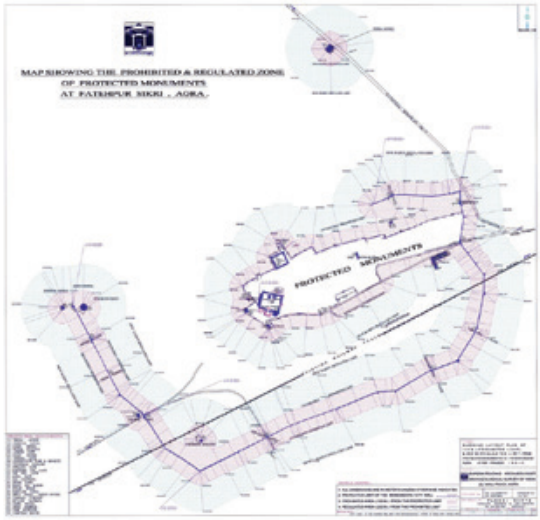

Fig. 3 Fatehpur Sikri: Delineation of UNESCO World Heritage Site's core and buffer area

Courtesy: Archaeological Survey of India, Agra Circle, Agra, Uttar Pradesh, India

4. Religious and Spiritual Precinct: Overview

Visitors to the site includes a large number of pilgrims who visit the Dargah of Sheikh Salim Chishti to pay obeisance and to seek fulfillment of their wish besides offering prayer in the *Jami Masjid,* among the largest in the Indian Subcontinent (Fig.4). A *Madrasa* (Islamic theological school) continues to run from the mosque precinct keeping the centuries old tradition of Islamic theological learning alive. In contrast to the secular part of the complex, the religious and spiritual precinct is a living one with the descendants of the Saint's family continuing to live in close proximity to the *Dargah.* Furthermore, a settlement whose year of origin may be difficult to establish with absolute certainty, also nestles at the foot of the ridge adding to the site's multi textured grain (Fig.5). The principal stakeholders engaging with the site are also diverse ranging from government bodies - Archaeological Survey of India, Nagar Palika Parishad (Urban Local Body), Town and Country Planning Office and Agra Development Authority to public agencies like the Waqf Board, besides the resident community, tourists and pilgrims. Further, being a UNESCO World Heritage site, international agencies notably UNESCO and ICCROM are also partners in ensuring its conservation.

Fig. 4 Fatehpur Sikri: Religious and spiritual precinct Courtesy: Author

Fig. 5 Fatehpur Sikri: Settlement around the religious and spiritual precinct Courtesy: Author

5. Precinct Attributes and Values

That Fatehpur Sikri has been inscribed as a World Heritage Site under Criteria (ii), (iii) and (iv) is a testimony of its high attributes and values. The religious and spiritual precinct comprises the *Jami Masjid* (Friday mosque) and the *Dargah* (place of interment) of Sheikh Salim Chishti, the latter standing within the large forecourt of the mosque. Entry into the precinct is via three gateways of which the Buland Darwaza, the loftiest, was built as a commemorative structure to celebrate imperial victory in war (Fig.6). The built form of the precinct has immovable and tangible attributes with values including architectural, artistic and technological that are of high quality. It also has intangible attributes by way of religious, spiritual, social and cultural values as the precinct sustains rituals, belief systems and religious practices that have continued unabated since the 16th century (Fig.7). The large courtyard of the mosque also acts as a space for community interaction. Further, the site also supports the local economy by catering to religious tourism.

Fig. 6 Fatehpur Sikri: Buland Darwaza opening into the Jami Mosque Courtyard Courtesy: Author

Fig. 7 Fatehpur Sikri: Shrine of Shaikh Salim Chishti Courtesy: Author

6. Precinct Risk Assessment

The management of risk constitutes a vital part of the overall site management framework for a historic site including UNESCO World Heritage Sites like Fatehpur Sikri. Indeed, the absence of risk assessment for a site increases its vulnerability to hazards both natural and manmade that could be of low, moderate to high impact. In case of Fatehpur Sikri, a scrutiny of the site's history that was recorded by the ASI in its colonial avatar since the late 19th century and continues to be recorded by ASI in its post independence avatar reveals that the site did not experience any major disaster, natural or manmade. This by no means implies that the site is not vulnerable to threats. An analysis of the various religious and social activities carried out in the religious and spiritual precinct supports the conclusion that fire and terrorism can be identified as the primary potential hazards impacting the precinct. Even as there is absence of any record of past fires in the precinct, there is certainly a risk of fire, particularly in the *Dargah* owing observance of rituals that include lamp lighting and incense burning. Further, the presence of inflammable material notably scared threads tied by pilgrims by way of wish fulfillment on the marble screens and offering of *Chadars* (scared cloth coverings) increases the vulnerability to fire. Likewise, the site has had no past event of terrorism, however an increase in the number of terrorist events in the past in India notably in religious and cultural sites makes the precinct vulnerable.

In the unfortunate eventuality of a fire or act of terrorism occurring on the site, it is projected that the precinct vulnerability will be accelerated by one or combination of the following conditions - inflammable nature of *Dargah* furnishings and ritualistic offerings, low quality/faulty electrical wiring, single entry-egress to *Dargah,* difficult vehicular access, scarcity of staff, lack of training in dealing with the hazard, absence of/dysfunctional fire fighting equipment, low awareness among local community, pilgrims and tourists, absence of a site emergency evacuation plan and lack of avaliability of life saving medical emergency measures, among others. Needless to say, the events will result in loss of intangible cultural values and social fabric rupture. On a tangible level, the loss will entail loss of life, injury, loss of livelihood and burning of homes and businesses. Furthermore, there will be loss of architectural, historic and artistic value via burning of soft furnishing and offerings, blackening of marble, breakage of building components - marble screens and columns, falling stone roof projections, splintering of stone, loss of carving and collapse of domes among others.

At the same time there are also slow impact risks affecting the site. These are centered on the human condition - high population density, low economic profile of residents, extreme overcrowding, poor infrastructure and depreciating building stock, on the one hand, and on human behavior - apathy, neglect and vandalism, on the other. The precinct is also vulnerable to

natural phenomenon like dust storms, pests, pollution, vegetation and weathering. These factors collectively pose a threat to the cultural attributes that the precinct embodies.

The vulnerability to risk is compounded by the fact that the coping capacity of the site stakeholders is poor with low levels of disaster awareness at all stages of its occurrence – preparedness, response and mitigation as well as recovery. The concomitant response by the stakeholders towards an eventuality is not only likely to be lacking in efficacy, but will also be underpinned by a strong fatalistic attitude. It is worthwhile to underscore that all risks identified above will impact the site in its entirety including its social and cultural fibre and not simply the built fabric.

7. Proposed DRM Plan for Fatehpur Sikri: Vision and Mission

The formulation of a DRM Plan for Fatehpur Sikri will be a vital intervention that will draw attention to disaster risk reduction through assessment of potential risks besides delineating the approach and methodology for dealing with risks through measures that will meaningfully engage all stakeholders, notably the residents, the state, visitors, social workers and professionals, to respond effectively at all levels. The Plan will also aim at enhancing the precinct's coping capacity by establishing a framework that draws in equal measure on conventional practices as well as on the reality of the site's regional and local context.

8. Risk Mitigation Measures

Various mitigation measures ranging from long to mid to short term envisaged for the precinct are as under:

Strategic Level Measures (Long Term)

① Regular monitoring of the legal provisions laid down for the Taj Trapezium Zone that bans polluting industries.
② Implementation of ASI's Nation Conservation Policy Article (15) that has provision for disaster risk management.
③ National Building Code has provision for fire safety but no provision with regard to cultural heritage. It is recommended that provision be made for inclusion of cultural heritage in the Code.
④ Making provision for cultural heritage in the National Disaster Management Framework.
⑤ Providing tax incentives for putting in place DRM Plans for cultural properties by stakeholders.

Planning Level Measures (Mid to Long Term)

① Local area building byelaws have provision for fire safety but no separate provision for cultural heritage. It is recommended that building byelaws for all new development include a clause that deals with cultural heritage that encompasses the site and its larger setting.
② Establishing Standard Operating Protocol for disaster risk management of cultural assets.
③ Making a Site Management Plan for the site.
④ Undertaking risk assessment mapping for the site.
⑤ Undertaking a cultural attribute and value assessment for the site by recording, mapping and digitizing all aspects of the cultural heritage.
⑥ Inventorizing the material objects in the Dargah and Mosque - lamps; ebony canopy over the Saint's grave; *Chadar* (fabric coverings).
⑦ Ensuring that a back up for all the assessments and inventories is made and kept in a safe place.

Technical Level Measures (Mid to Short Term)

① Conducting training programme for the watch and ward staff on disaster risk reduction.
② Regularly monitoring *Dargah* activities by the Waqf Board watch and ward staff.

③ Undertaking periodic maintenance and monitoring of the wiring system in the precinct.
④ Carrying out regular maintenance of the various traditional water systems of the site to check blockages.
⑤ Bolstering staff strength.
⑥ Improving security of the site.

Community Level Measures (Mid to Short Term)

① Engaging with the religious / spiritual heads of the site to underscore their role as leaders of the community particularly in times of emergency..
② Building awareness among the local community, pilgrims and tourists about the cultural value of the site and the risk of disaster.
③ Undertaking risk mapping by the community on the site and the environs to foster a stronger sense of heritage ownership and its stewardship.
④ Encouraging the community to take up voluntary watch and ward in the area.

9. Emergency Preparedness and Response

The emergency preparedness response draws on the fact that the site is relatively isolated with the nearest urban centre, Agra being 37 Km. away. This reality becomes a determinant of the response in that it relies largely on self help by way of an immediate response by the local community. This entails the creation of an on site stakeholders emergency response team with roles clearly delineated in consultation with local police and political representatives and are based on cost effective, do-able measures.

Some proposed measures are as under:

① Round the clock monitoring by hired watch and ward staff.
② Carrying out annual electrical audit of all electrical installations in the precinct.
③ Manning the *Dargah's* single entry cum egress to keep it clear of devotees and objects at all times.
④ Using the mosque's public address system to sound alert.
⑤ Alerting the on site emergency response team via a mobile application.
⑥ Displaying and marking evacuation routes and refuge areas via a map at the all entry points to the precinct. Further, marking evacuation routes and refuge areas on the entry ticket to rest of the site.
⑦ Training response team members notably site tour guides, to guide public – pilgrims and visitors to safety.
⑧ Engaging with religious / spiritual leaders to seek consent for relying on the traditional water sources namely mosque ablution pool, wells and tanks to fight fire as part of emergency response.
⑨ Installing firefighting equipment including battery operated smoke detector & alarm, fire extinguishers, water hose and pump system that use water from the traditional water systems.
⑩ Preparing guidelines for standard operating procedures for disaster outbreak at national, state, inter-state and civic levels of governance.
⑪ Devising management protocols for media and politicians.
⑫ Designating parking area for fire engine and ambulance in the site parking lot.
⑬ Creating obstacle free routes to evacuation areas.
⑭ Organising regular fire drills.
⑮ Linking important festivals like the Saint's birth and death anniversaries to events like observance of Fire Safety Day.
⑯ Maintaining all traditional water systems on site.
⑰ Setting up CCTV cameras in ticketing area for effective surveillance.
⑱ Setting up an on site control room for disaster management.

10. Recovery Plan

The recovery plan for the precinct involves all site stakeholders and is to be carried out in three phases namely short, medium and long term as indicated in the Table.

Agencies	Short Term	Medium Term	Long Term
1. Central Government (Ministry of Culture) 2. Central Agencies and Institutions (ASI, NMA, NIA, CBI etc.)	1. Evacuation. 2. Relief distribution. 3. Removing debris. 4. Propping up / securing structures that can pose a risk. 5. Cordoning off the site.	1. Initiating conservation work. 2. Reopening of site to public. 3. Making a Site Management Plan. 4. Making a Disaster Management Plan. 5. Increasing surveillance and information sharing.	1. Implementing conservation works. 2. Formulating heritage bye-laws for buffer area.
1. State Government 2. Municipal Authority 3. Development Authority 4. Paramilitary forces 5. Police 6. Fire Department 7. Community 8. NGOs / Volunteer groups	1. Undertaking relief work. 2. Removing the injured to nearby hospitals. 3. Running relief camps for the displaced. 4. Restoring public services. 5. Securing public infrastructure. 6. Removing debris.	1. Providing interest free loans to reinitiate local businesses. 2. Providing subsidy to affected people in the core and buffer area to rebuild homes. 3. Upgrading and maintaining infrastructure like water supply and installation of fire safety measures.	1. Equipping the primary health centre to handle emergencies. 2. Establishing a Block level fire office. 3. Maintaining infrastructure. 4. Undertaking capacity building through awareness drives. 5. Hiring more personnel. 6. Conducting regular fire drills.

11. Conclusion

The DRM Plan for Fatehpur Sikri demonstrates that the conventional approach of regarding culture and risks as two disconnected entities has to be replaced by a new way of thinking where heritage needs to be examined from a risk perspective. This approach is warranted not only for the country's UNESCO World Heritage properties like Fatehpur Sikri but also for other sites. Given the vast corpus of heritage that exists in India, a policy of prioritization can be adopted where DRM Plans can be made beginning with the UNESCO World Heritage properties followed by plans for sites of national, regional and local significance. Safeguarding culture against potential risks is one of the vital measures to ensure that the country is treading on the path of sustainable development in keeping with the global development paradigm.

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3.2 Disaster Risk Management of Al-Hadba'a Minaret's site

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1. Introduction

Iraq is the cradle of one of the ancient civilizations in the humanity age and many civilizations came along the time one by one, till the last empire of Abbasy. Also, Iraq considers as one of the good places of the world to have many cultural heritages, according to the geographical site and the environmental factors of it.

Through the time, each civilization made a ground signature by set up a monument refers to that civilization and later these monuments survived against the human and environment effects by the time to be a very important cultural heritage (Watt & et. al.,2009).

Our case study considers as one of the important monuments in Iraq and is located north parts of Iraq in the middle of Mosul city at latitude (36 ˚ 20′ 36″ N) and longitude (43 ˚ 07′ 37″ E) (Fig.1).

The old heritage of Al-hadba'a Minaret in Mosul is a famous monument for its considerable height and leaning even after approximately 800 years since its construction still withstanding degradation. Such as Pizza tower which been built in the same period (Fig.2).

Fig. 1 Location of the study area

Fig. 2 Pizza tower and Hadba'a minaret images

2. Attributes of Al-Hadba'a sites

Al-Hadba'a minaret is important to the study of human history because it could provide a concrete basis for ideas, and can validate it. It's preservation demonstrates the recognition of the necessity of the past and of the things that tell its story. Preserved monuments also validate memories; and the actuality of the object, as opposed to a reproduction or surrogate, draws people in and gives them a literal way of touching the past. This unfortunately poses a danger as places and things are damaged by the Natural hazards, hands of tourists and other risks of making an object known and available.

The study area has many values and attributes, and the most important value for the whole site generally is the historical value because the site been built since 800 years and the minaret of the site still stand. The symbolism value comes after the first one because the local community has spiritual connection with the minaret and consider it as one of the most important symbol of Mosul city and whole Iraq. Therefore, we are going to display some of this site attributes to show the valuable factor for this monument (Table 1).

Table 1 The attributes of Al-Hadba'a Site

S.N.	Attributes of your Site and their location (Refer Map)	Type of attribute (movable/immovable, tangible/intangible, natural/cultural/mixed)	Associated Values (in bullets).	Scores for each Value 1(low), 2(Medium), 3(High)	Stakeholders for these values
1	The tower of the Hadba'a minaret	• Immovable • Tangible • Cultural	• Historical • Symbolism • Spiritual • Cultural • Religious	- 3 - 3 - 3 - 3 - 2	- community - Ministry of culture - Local government -UNESCO
2	The artistic pattern on the minaret as circle shapes	• Tangible • Cultural	• Artistic • Historical • Cultural	- 3 - 3 - 2	-History scientist -Arabian pattern Artists -Ministry of culture..
3	The Mosque which is near to the tower	• Immovable • Tangible • Cultural	• Historical • Religious • Spiritual	- 2 - 3 - 3	-Muslim prayers. -Ministry of religious affairs. -Community.
4	The old place of ambulation	• Immovable • Tangible	• Religious • Cultural • Social • Historical	- 2 - 3 - 2 - 3	-community -Ministry of culture -Local government -Museum.

3. The vulnerability of the site

In this cultural heritage site there are some vulnerability which could affect directly or indirectly on the stability of the minaret and the vicinity area. The most important and more affection vulnerability factor here is the cavity, which exist underneath the whole site and especially underneath the minaret. The cavity been made in the basement rocks under the soil cover, and these rocks consist mainly of Gypsum rock, which is highly dissolved by the water and any acidic liquid. As known that Mosul city settled over a considerable prevalence of a Gypsum rocks in the whole area (Buday,1980) (Fig. 3).

Through the time these rocks been dissolved by the underground water , whether is natural water or came from waste water through leakage in the waste pipe system. Those sources considers the main sources to produces the cavity and its extension and also those sources affecting on the minaret shape by leaning the structure of the minaret toward the east (Abed & Ghassan, 2013) (Fig.4).

The second vulnerability factor of the risk in the site is the existed cracks in the minaret's base structure. These cracks have high risky value for being more developed in the future and then that will lead into structure failure and collapsing of the minaret (Taib & et. al., 2010) (Fig.5).

The third vulnerability factor in study area is the continues failure in the sewage system in the area, which is always has leakage of the sewage water and then that would help in dissolving the bedrocks (Gypsum), and then enlarging the cavity.

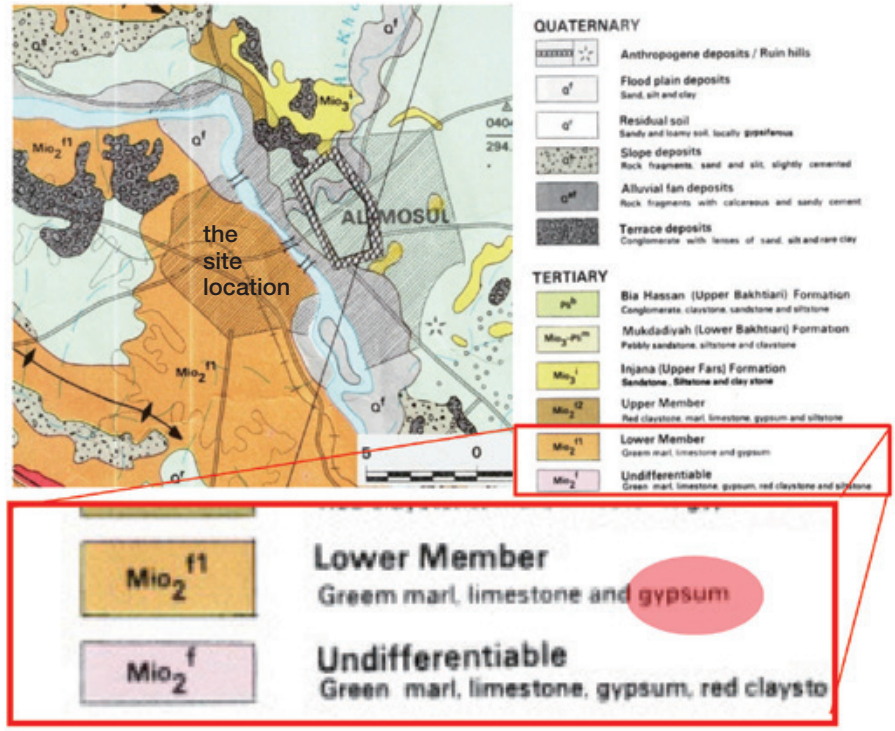

Fig. 3 Geological map of the study area and the vicinity area

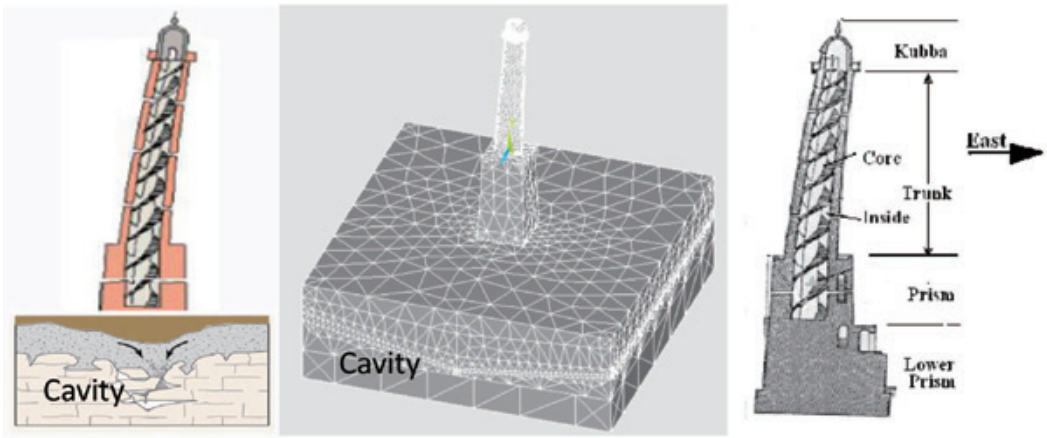

Fig. 4 Shows the cavity underneath the minaret and leaning of the minaret shape (ref. 3 & 4)

Fig. 5 The cracks in the base and the body of the minaret

4. Population

The study area has a high amount of people settled around the monument site from all directions and very close to the site. The high population around the site rises the risk rate of the human causality in case any disaster would happen in the study area. So, the disaster risk management wouldn't just protect the monument from collapsing, but also to save the human lives in the surrounded area (Fig.6).

Name of the area	Pop.	Color of the area	Area msq²
A	472	Green	1891
B	947	Blue	5184
C	1575	Yellow	7762
D	Prayers	Red	925

Fig. 6 Population in the study area

5. Disaster risk management plan

As a result from this study, a disaster risk management plan has been made and concluded to manage the site-in to be aware from any risk of disaster could happen in the site and to preserve the monument (the minaret) from collapsing, also, to protect the residential area from that risk as well.

Plan will have effective procedures that promote the way of preserving the monument from collapsing and protect the people from any threats of the collapsing by natural and human-made disasters at future (Fig.7).

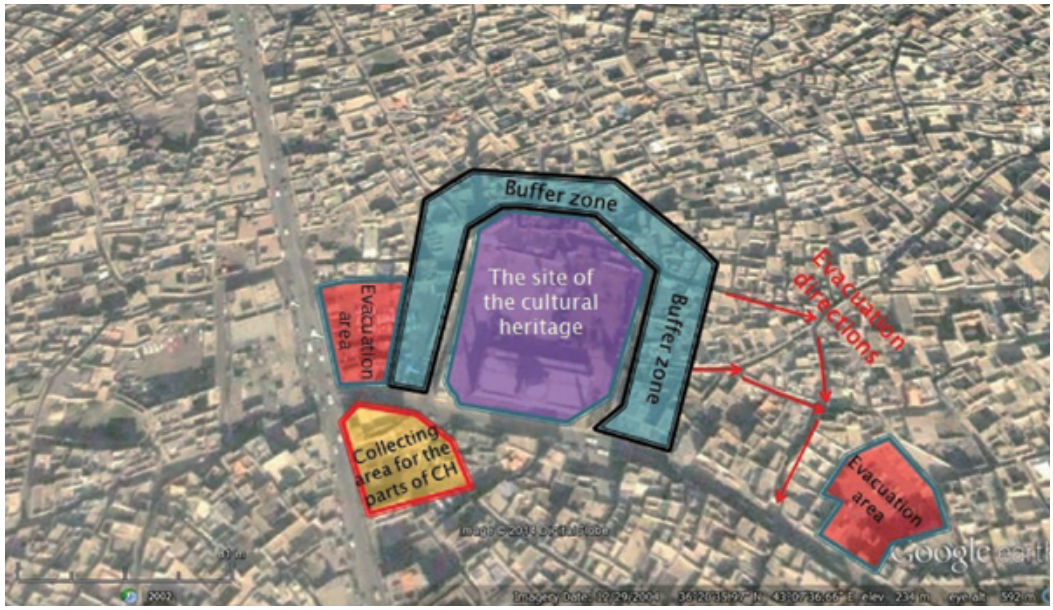

Fig. 7 Disaster risk management plan for the study area

The procedures in the plan will contains of:

① Make an underground scanning to the CH site to determine the cavity and its size and extension by modern technology such as GPR.

② Grouting those cavities by appropriates materials to prevent the collapsing of the cavities with respect to the gases pressure inside these cavities.

③ Fixing the cracks in the minaret's body by advanced utilities to prevent the failure in the cracks, which would lead into body failure.

④ Constructing a buffer zone around the site with width around 200 meters, and planting a tree and green grass in that buffer zone to make it as a leisure area for the local community.

⑤ Set a virtual evacuation area near to the site to evacuate the people in case any disaster would happen, and in the study area we determined two area because it is car parking area and it would be good option to be as evacuation area and easy to reach to.

⑥ Set a virtual area for collecting the CH parts in case of the disaster to prevent any robbery of the precious parts of the monument through the disaster, and this area would be with big space surrounded by building to be guarded well.

⑦ Action plan has been proposed in this site to mitigate and assess any risk would happen in this site and also post-disaster (Fig.8).

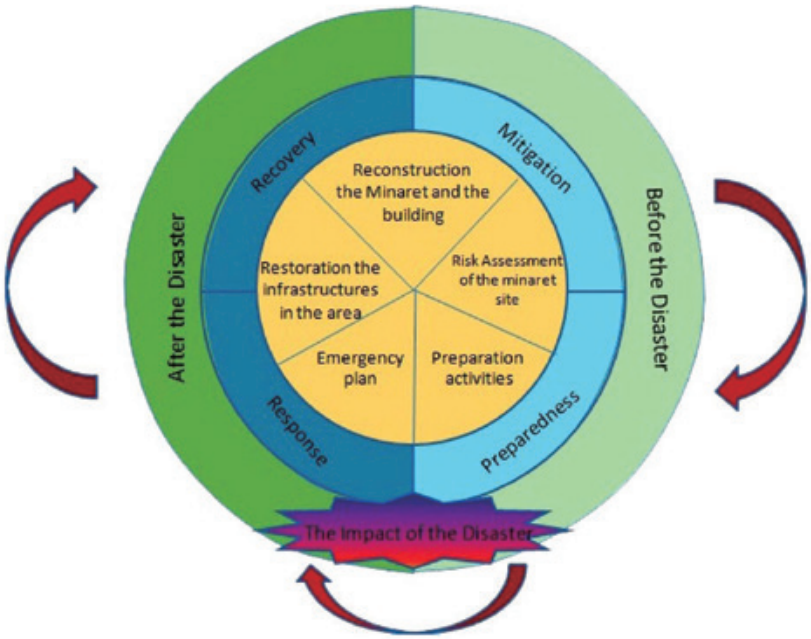

Fig. 8 Proposed action plan of the study area

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3.3 Lahore Fort

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1. Introduction (Fig. 1)

This article comprises of the context reproduced in the light of International Training Course of Disaster Risk Management of Cultural Heritage under UNESCO Chair Program held from 06-22-Septumber, 2014 at R-DMUCH, Kyoto, Japan. History with back ground knowledge of the fort, attributes, hazards, risks and vulnerabilities, mitigation strategies for fire, stages of agent control for fire and flood and recovery plan are briefly described in this article. It is strongly recommended to furnish DRM Plan and implement it accordingly through coordination of all stakeholders and line agencies.

Fig. 1 Inscribed on World Heritage List (N171) in 1981 based on criteria I, II and III Lahore Fort Cooedinates: Loftgitude: 74, 3097E, Latitude=39. 5903N

2. History

Lahore Fort is located at an eminence in the northwest corner of the Walled City of Lahore, Punjab, Pakistan. The citadel covers about 50 acres and is trapezoidal in form. The origin of this fort goes back to Mythical as its foundation is attributed to Prince Lob, son of Rama with its 1st historic reference date from before the 11th century. The present fortifications were begun by Mughal Emperor Jalaluddin Muhammad Akbar. There is evidence that a mud fort was existed here in 1021, when Mahmud of Ghazni invaded this area. Akbar demolished the old mud fort and constructed most of the modern fort on the old foundations. The fort's mud construction dates back to the early Hindu period. The fort is mentioned in connection with Muhammad Sam's invasions of Lahore in 1180, 1184, and 1186. It was ruined by the Mongols in 1241, and then rebuilt by Balban in 1267. It was again destroyed by Amir Taimur's army in 1398, to be rebuilt in mud by Sultan Mubarak Shah in 1421, then taken and repaired by Shaikh Ali. The present fort, in brick and solid masonry, was built during Akbar's reign between 1556 and 1605. Every successor Mughal emperor, as well as the Sikhs and the British, added a pavilion, palace, or wall to the Lahore Fort, making it the only monument in Pakistan which represents a complete history of Mughal architecture.

There are two huge gates in the fortifications, one each in the middle of the east and the west sides. The western gate, known as Alamgiri Gate, is presently used as the main entrance. The

Masjidi Gate, Eastern Gate, built in 1666 during Akbar's reign, was the original entrance to the fort and faces the historic Maryam Zamani Mosque.
Alamgiri Gate, a magnificent double-storey gate, was built by Emperor Mohiuddin Aurangzeb Alamgir in 1673 and faces the grand Badshahi Mosque and opens into Hazuri Bagh. The fortification wall is built of small burnt bricks strengthened with semicircular bastions at regular intervals. The mural wall turns the corner and continues as the north fortification wall, with several pavilions situated on the top and overlooking the north aspect?this is the area where once the waters of the Ravi washed the foundations of the fortification wall. No specific Disaster Management / Fire Fighting System exist for the Lahore Fort. In 1955, Flood damaged the fort. In 1988 Flood protection bunds saved the city and fort from flood damage. Interestingly, the same architect, Abdul Karim Mamur Khan, was employed by Jahangir and during the early part of Shah Jahan's reign.
The citadel is divided into different sections, each creating its own world within its quadrangle. The three great Mughal emperors namely Akbar, Jahangir and Shah Jahan are remembered for their great architectural work in this regard. The fourth, Emperor Aurangzeb Alamgir, constructed the impressive Badshahi Mosque and, like the other three, left an indelible architectural mark on the cultural map of Lahore.
The following are worth mentioning while describing Lahore Fort:

① Alamgiri Gate
② Gateway Ramparts.
③ Dewan-E-Khas.
④ Dewan-E-Aam
⑤ Daulat Khana-E-Khas-O-Aam
⑥ Sheesh Mahal
⑦ Naulakha Pavilion
⑧ Hathipar (Elephant Path)
⑨ Moti Masjid
⑩ Hazuri Bagh
⑪ Jahangir's Quadrangle
⑫ khavabgah- e-shah jahan (sleeping chamber)
⑬ PaienBagh (Ladies Garden)
⑭ AthDarra (Building having eight openings)
⑮ Shah Burj Gate
⑯ Makatib Khana
⑰ Haveli of Kharak Singh
⑱ Zenana Hammam
⑲ Paien Bagh and Khilwat Khana (Chamber of Seclusion) Quadrangle
⑳ Lal and Kala Burj (Scarlet and Black Towers)
㉑ Shah Burj or Royal Tower
㉒ Reception Court
㉓ Ranjit Singh's Athdarra

Dewan-e-Aam (Garden of Public Audience) located in the south of the citadel, is the earliest and the most important element of Mughal court ceremonial spaces. Its generous dimensions of 730'x460' providing an arena of enormous scale once framed by a perimeter of cloisters, it allowed the pageantry of the Mughal court to be enacted with extraordinary splendor. Much damage was caused during the Sikh occupancy and Inter-Sikh wars, and after annexation many cloisters were demolished to construct European artillery and infantry barracks when the Mughal fort served as a British cantonment.
Diwan-e-Khass is the marble pavilion of exquisite beauty, when the Ravi flowed along the north

fortification wall, the cusped arched openings on the north, carrying marble geometric framework screens incorporating viewing windows would have provided a delightful prospect.

Dewan-E-Khas " Hall of Private Audience" was Built by Wazir Khan, the then Governor of Lahore in 1645 AD, measuring 53 Feet By 51 Feet, The entire Construction is in Chaste White Marble. This is where the emperor listened to petitions of VIP's and after processing were stamped by the royal seal. During British period it was converted into a chappel. Floor is laid in marble intarsia of different colors in geometrical pattern and a fine cup shaped. It is decorated with Petra Dura work.

Daulat Khana-e-Khass-o-Aam is accessed by following the steps to takht-jharoka. It is a building cleverly placed to provide transition from the highly public area of the Diwan-e-Aam to the private residential apartments of the imperial harem.

Makatib Khana is located in the northwest corner of the Maidan Diwan-e-Aam. It was designed by one of the most accomplished Mughal architects-Abdul Karim titled Mamur Khan. This structure is conjectured to be part of a group of royal mansions on which the princely sum of seven lakhs Rupees was expended, and which were much acclaimed by Emperor Jahangir in his delightful memoirs.

Haveli of Mai Jindan dominates the eastern periphery of the Moti Mosque Quadrangle. Mai Jindan, (Chandan or Chand Kaur), was the mother of the infant Sikh ruler, Dulip Singh. This two-storey building may have originally been a Mughal structure, however, it is considered a Sikh structure due to large-scale additions by the Sikhs.

Jahangir's Quadrangle was begun by Akbar and completed by Jahangir in 1618 and contains some of the earliest Mughal structures in the fort. The river Ravi once flowed at the foot of the north fortification.

Haveli of Kharak Singh, the heir to Ranjit Singh, occupies the southeast corner of Jahangir's Quadrangle.

Hammam occupies the southwest corner. A Sikh-period map identifies it as a bath (hammam). It is likely that this is the hammam that was built for the use of the imperial female entourage of the emperor.

Paien Bagh and Khilwat Khana (Chamber of Seclusion) Quadrangle are in continuation with each other. Most of the structures are now lost, except the two major towers.

Khilwat Khana, a small bangladar pavilion of uncertain origin, lies in the centre of the northern edge of the Paien Bagh. This building, marked as the 'Hall of Perfumes' on Sikh Period maps, is usually referred to as the Khassa Khana.

Lal and Kala Burj (Scarlet and Black Towers), constructed by the Sikhs, are massive 4-storey structures and are thought to have been used as residential apartments.

Shah Burj or Royal Tower is the most well documented group of buildings in the Fort.

Reception Court occupies the first part of the group of buildings of Shah Burj.

Ranjit Singh's Athdara is located on the western periphery of the reception court, beyond which is situated the Shah Burj.

Shish Mahal was the palace where after the annexation of the Punjab by the British, the sovereignty of the Punjab, along with the fabulous Kohinoor diamond, was passed into the hands of the British. Its white marble arcade composed of sculpted shash-hilali (6-crescent) arches, and the cusped profile of engrailed spandrels is outlined with a delicate line of incised marble inlay.

Naulakha Pavilion is the only other structure that can claim to rival the celebrated Shish Mahal. Naulakha is probably a Sikh appellation. This structure is placed at the central axis of the hauz (water reservoir) and is notable for its drooping bangladar roof, and distinctive pietra dura.

3. Attributes of Lahore Fort Associated Values and Stakeholders: Outstanding Universal Value

Lahore Fort and Shalamar Gardens Nominations were proposed for World Heritage List under Criteria1, 2 & 3 (Table 1).

① Represent a masterpiece of human creative genius

② Exhibits an important interchange of human values, over a span of time or within a cultural area of world, on developments in architecture or technology, monumental arts town planning or

landscape design.

③ Bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared

Table 1

S. No.	Attributes of Lahore Fort Site and their location	Type of attribute (movable/ immovable, tangible/ intangible, natural/cultural/ mixed)	Associated Values	Scores for each Value 1(low), 2(Medium), 3(High)	Stakeholders for these values
1	Alamgiri Gate (Main Gate) The main gate of the fort facing towards the Royal Mosque.	• Immovable • Tangible • Cultural	• Architectural and Aesthetic (As of Mughal Era) • Historical(Mythical origin, destroyed and rebuilt, present shape in the reign of Aurangzeb Alamgir) • Social(meeting Place for people) • Technological (speaks volumes of architectural era of Mughals) • Cultural (The main recognition of the fort)	3 3 1 2 3	Archeology Department,& community in shape of visitors and vendors
2	Dewan-e-Khas. The Diwan-i-Khas is square in plan with five bays of lobed arches on three sides. The north facade includes delicate jali screens that overlook the northern ramparts of the fort. A shallow fountain sits at the center of the pavilion	• Immovable • Tangible • Cultural	• Architectural & Aesthetic(As hall mark of the forte) • Historical(As history can be traced back since the Mughal Era) Arhitectural / Technological / Aesthetic	3 3	Archeology Department, Visitors
3	Dewan-i-Aam: During the first year of his reign, i.e. in 1628, the emperor Shah Jahan ordered the construction of the Diwan-i-Am. It was built in the shape of a hall of forty lofty pillars of red sandstone. Standing on a large rectangular platform, the hall measures 187 feet by 60 feet and rises to a height of 34 feet.	• Immovable • Tangible • Cultural	• Architectural & Aesthetic (As hall mark of the forte) • Historical(As history can be traced back since the Mughal Era) • Arhitectural/ Technological/ Aesthetic • Social(visitors) • Economical(little income)	3 3 2 1 1	Archeology Department, Visitors

4	Shish Mahal: The Sheesh Mahal (The Palace of Mirrors; is located within the Shah Burj block in northern-western corner of Lahore Fort. It was constructed under the reign of Mughal Emperor Shah Jahan in 1631-32. The ornate white marble pavilion is inlaid with pietra dura and complex mirror-work of the finest quality. The hall was reserved for personal use by the imperial family and close aides. It is among the 21 monuments that were built by successive Mughal emperors inside Lahore Fort, and forms the jewel in the Fort's crown.As part of the larger Lahore Fort Complex, it has been inscribed as a UNESCO World Heritage Site since 1981.	• Immovable • Tnagible • Cultural	• Architectural& Aesthetic (As hall mark of the forte) • Historical(As history can be traced back since the Mughal Era) • Arhitectural/ Technological/ Aesthetic • Social(visitors • Economical(little income)	3 3 3 2 1	Department of Archeology and visitors
5	Museum:the Armourey Museum, also known as the Fort Museum. It is said that the architecture of the museum is worth the trip alone, with its classic Mughal era workmanship.	• Immovable • Tangible • Cultural	• Architectural & Aesthetic (As hall mark of the forte) • Historical(As history can be traced back since the Mughal Era) • Social(visitors) • Economical(little income)	3 3 3 3	Archeology Department and Visitors

Catastrophic and Slow Hazards Likely to Affect the Fort

Hydro Metrological Hazards

- Climate Change
- Thunder storm and Tornadoes
- Drought
- Extreme cold / Heat

GEOPHYSICAL HAZARDS

- Mass Movements
- Conflict
- Terrorism
- IDP's
- Soil Erosion and Contamination
- Political Pressure
- Economical Pressure

Biological / Ecological Hazards

- Plant disease
- Parts
- Erosion (of Biodiversity)

Astronomical Hazard

- Hazards From Space

Most Common Hazards

- Floods
- Fire
- Earthquake
- Lightening
- Landslide
- Stampede

4. Risks and Vulnerabilities (Fig. 2)

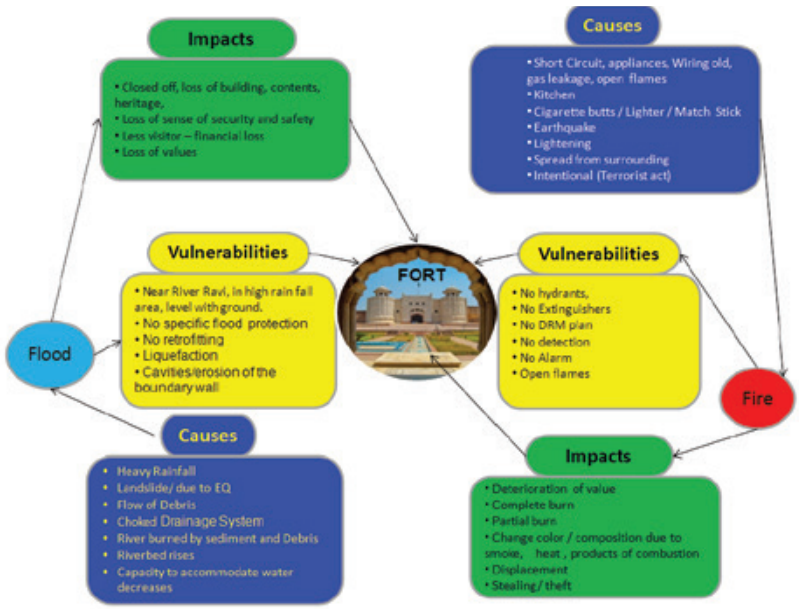

Fig. 2 IRisks and Vulnerabilities

5. Mitigation Strategies for Fire (Table 2)

Table 2 Mitigation Strategies for Fire

S. No.	COMPONENT	FIRE	FLOOD
1	Strategic Level	Implementation on fire safety act 2007	Incorporate the protection of forte in flood plan of the district.
2	OperationalLevel	Diversion of traffic around the forte,setup fire unit in the forte	Already built protection bund need repair at some points
3	Environmental Strategies	Plantationof trees, awareness seminars	Plantationof trees, awareness seminars
4	TechnicalLevel	Firefighting	Raisingofthelowlyingareanearwestandeast gates,repairoferodedboundarywalls,reinforcementofthewalls.
5	Material	Fire Resistant material, fire proofing, non inflammables	waterresistantcoatingoncollectionsofMuseums.
6	Maintenance and Monitoring	Fire alarms,smoke / heat detectors, firefighting system, hydrants, hoses, water source with back up	Regular checking of water gauges of water level in river Ravi, Rain forecast, Snowfall/melt, debris, landslide, drainage system, Evacuation drills, shifting of collections/artifacts from museum, Preparation/updating of earthquakehazard map.

6. Stages of Agent Control (Table. 3)

Table 3 Stages of Agent Control

S. No.	COMPONENT	FIRE	FLOOD
1	Avoid	Fire through continuous monitoring and maintenance of fire prevention and fighting system, anti lightening measures.	Through survey and rising of the flood prone area of the fort, weather forecast. Snowfall/melt and water level monitoring choking of drainage system.
2	Block	Anti fire coating in Museum, plantation of trees, water shield, separation of materials.	By planting trees around the fort and in the vicinity. Protection bunds, spurs.
3	Detect	Regular check up on source of fire and their separation/removal accordingly.	Through water Gauges, forecast, Early Warning system
4	Response	Internally and Rescue Services	Shifting of collections/artifacts from the museum if flooding is likely to affect the museum.
5	Recover / Treat	The damaged / lost property value	The affect area/part/articles, redress the weak points

7. Recovery Plan (Fig. 3)

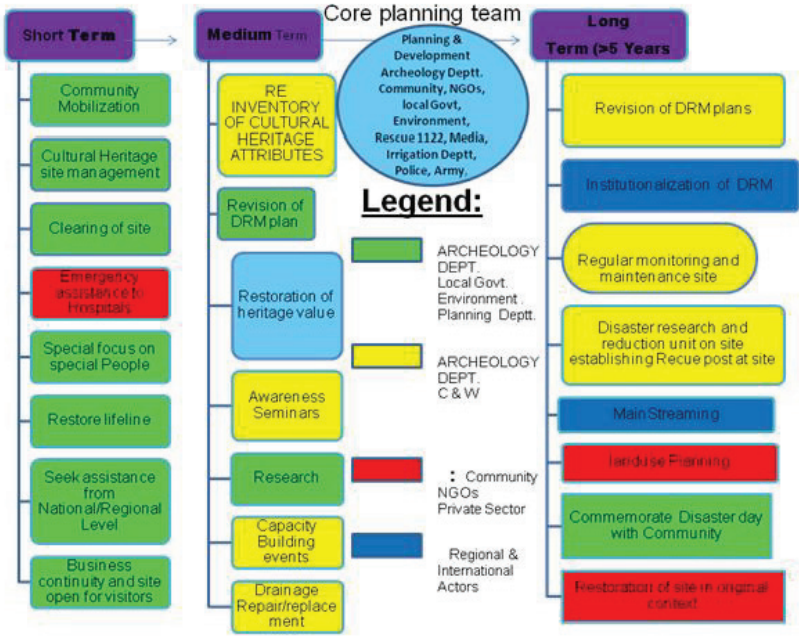

Fig. 3 Recovery Plan

3.4 The Disaster Risk Management Plan for the Krak des Chevaliers (Alhosn Castle) in Syria - It had an impact both in the East and in the West

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1. Introduction

The Krak des Chevaliers, also Crac des Chevaliers (French for "Fortress of Knights"; Arabic: *Qala'at Al-Hosn*) is widely recognised as archetypal Crusader castle in Syria (near the city of Homs), and one of the most important preserved medieval castles in the world as shown in Fig. 1. The castle has two parts: an outside wall with 13 towers and an inside wall and keep as shown in Fig. 2. The two parts are separated by a moat which was used to fill the baths and water the horses. During an external attack, this moat is filled with water and used as trench for defense. The castle represents the most significant example illustrating the exchange of influences and documenting the evolution of fortified architecture in the Near East during the Byzantine, Crusader and Islamic periods. There are generally two major campaigns fortification site, the campaign Hospital (1142-1271) and the campaign of the Mamluks (1271-1300). It ranks among the best-preserved examples of the Crusader castles and is located on hill top a 650-metre-high dominating visually the surrounding landscape. Since 2006, the castle has been recognised by UNESCO as a World Heritage Site as shown in the Table 1 [1)].

Fig. 1 The location of the Alhosn Castle near the city of Homs in Syria

Table 1 Some information about the Krak des Chevaliers [2)]

Serial ID Number	Name & Location	Coordinates	Area	Date Inscribed
1229-001	Crac des Chevaliers Al Hosn, Gouvernorat de Homs, Syrian Arab Republic	N34 47 11.00 E36 16 6.00	Property: 2.38 Ha Buffer zone: 37.69 Ha	2006

Fig. 2 The two outside and inside parts of the Alhosn Castle [1)]

2. Significant Values (Authenticity/Integrity)

The Krak des Chevaliers represents a significant development in the fortification systems, which substantially deferred from the European rather more passive defense systems, and which also contributed to the development of the castles in the Levant. It represents the most significant example illustrating the exchange of influences and documenting the evolution in this field (which had an impact both in the East and in the West). According to the criteria (ii)(iv): In the history of architecture, the Krac is taken as the best preserved example of the castles of the crusader period, and it is also seen as an archetype of a medieval castle particularly in the context of the military orders [2)].

The present state of conservation

The site currently has a conservation status which can be described as very satisfactory, and it is now among the best-preserved castles of the time. The castle proposed for inscription on the World Heritage List and included on the Tentative List of the Syria since 1999 and have been continuously protected by the Syrian Antiquities Law (no. 222, revised in 1999) and by the Law of the Ministry of Local Administration (15/1971) which contributes to its protection in coordination with the Directorate General of Antiquities and Museums (DGAM) and the local authorities [3)].

The main characteristics and architectural features

From the point of view of the history of military architecture and fortifications, the castle has many unique elements throughout its many transformations and additions interest. Some of these elements are:

① The castle-hall which consists of two parallel lines, concentric walls forming between them a wide continuous corridor arched edges to neutral feature that serves to link the original constitution of the hospital castle.
② The dungeon which is a set of towers and buildings according to the nerve center of the fortress and keeps together the dormitories, the refectory of the knights, community rooms and the home of the commander of the Hospitallers.
③ The glaze, which surrounds the castle on the top fronts south, west and north, is remarkable for the quality of the camera and the perfect stereotomy of its stone blocks to the intersection with the round towers of the dungeon as shown in Fig. 3.

Fig. 3 The glaze and dungeon of the Krac des Chevaliers [3)]

3. Risk Assessment & Management

There are several factors affecting the castle such as

① the development pressures
② the constraints due to the environment
③ the stresses due to the flow of visitors/tourism
④ the number of inhabitants within site
⑤ the terrorism acts that hit Syria started March 2011 and continuing till the time of writing this article
⑥ the natural disasters which are the main concern of this paper and will be discussed below

The terrorism acts that affected the Castle during the period (March 2012-April 2014)

After the return of calm to the area of Krak des Chevaliers in April 2014, the DGAM entered the castle, and identified the nature of the internal damage as shown in Fig. 4. Some main parts such as: 1) The destruction of the stairs in front of the fort and the inner halls are full. 2) Partially damaged in the front hall of the Knights. 3) Damages in interface King Tower girl, etc. more information can be seen on [3)].

Fig. 4 The front hall of the Knights before and after the terrorist acts [3)]

The tectonic and seismic situation of Syria

Syria is located on the northern tip of the Arabian plate. Fig. 5 shows the map of ground accelerations that contained in the geometric code of 2004, which shows the maximum values of the potential ground accelerations on rock layer during 50 years with the possibility of not to exceed 90 percent estimated cm/sec square. Where the ground accelerations map is divided into six different ranges and the Krak is located within the area of ground accelerations (300-400) cm/sec square [4)].

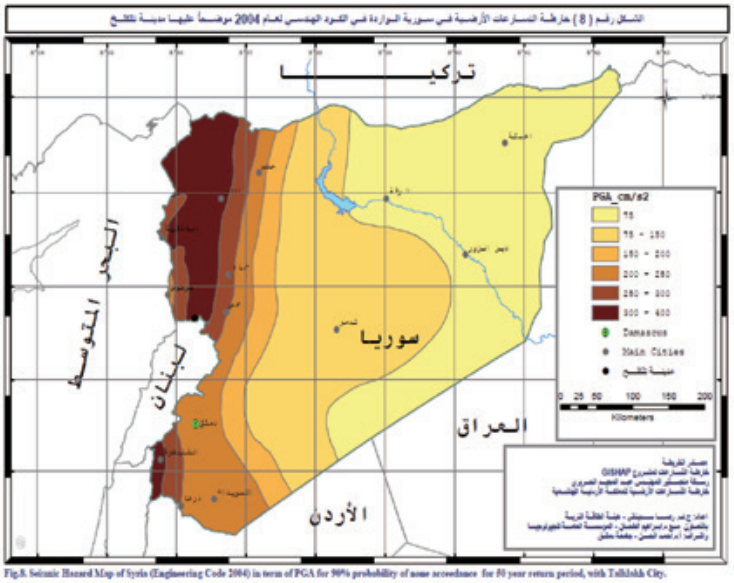

Fig. 5 Seismic Hazard Map of Syria [4)]

Hazard and Vulnerability Analysis

Fig. 6 depicts the elements of risk, impacts, and the two scenarios (the most and less extreme) for the castle. While Table 2 outlines the recovery activities and procedures that will be carried out,

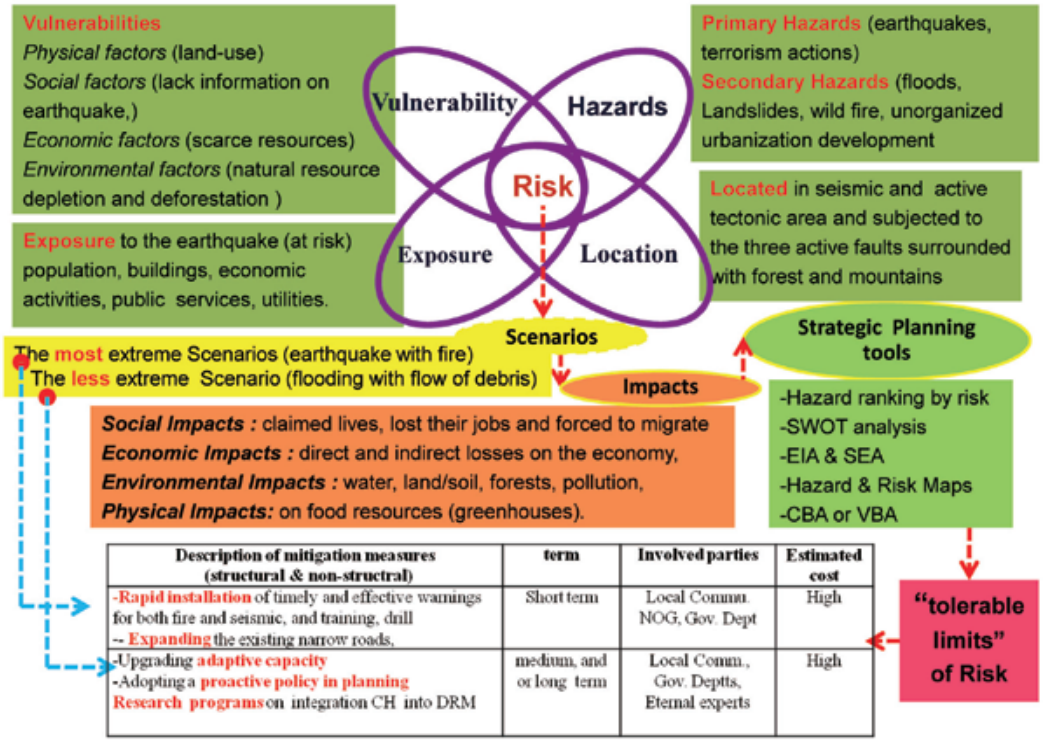

Fig. 6 The elements of risk, impacts, and the two scenarios (the most and less extreme) for the castle

Table 2 The recovery activities and procedures

		Recovery activities and procedures		
		Early term 6 months	Short term 1-2 years	Medium and Long term 3-6 years
Engaged Actors	Local Community, NGOs	cleaning the site and initial maintenance	Supporting works	Rising awareness and site watching
	All national related Governmental Departments	Damages assessment as each department will carry out its special task (e.g., water, electricity)	Conservation interventions, structural stabilisation, landscape recovery	Building and promoting the DRM & CH, capacity building, R&D,
	UNESCO, International Agencies, INGOs,			Experience, fund

4. Conclusion and Future reconstruction projects for the site of Castle

The idea here is how to use the built cultural heritage as a driving factor to stimulate regional development? This can be achieved through solidity of the cultured wheel (RD: jobs, investments, research, added value) as shown in Fig. 7. The main points that can be concluded:

① Seeking for methods and mechanism of revalorisation of built heritage using a market led approach
② Stimulation of socio- economical development
③ Renew interest in the heritage
④ Involvement of local community

To achieve the above objectives, Table 3 presents the future reconstruction projects for the site of castle [5]. The author of this article with cooperation from Ghent University in Belgium, and some

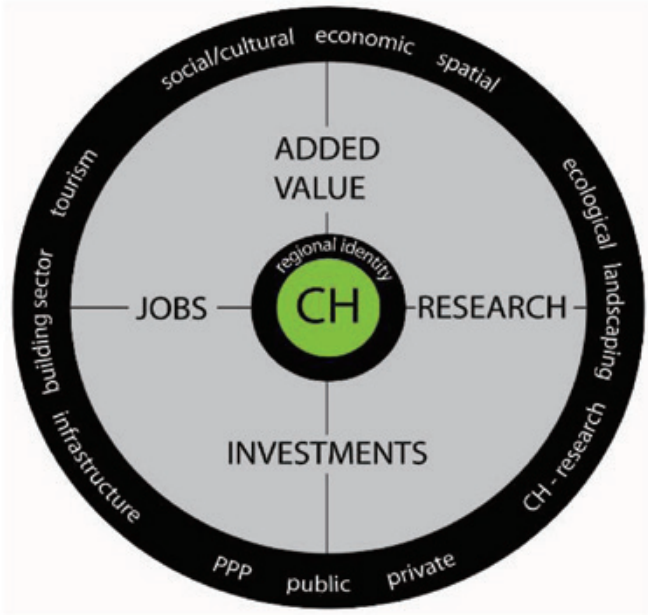

Fig. 7 The elements of the cultured wheel (jobs, investments, research, added value) [5]

Table 3 The Future reconstruction projects for the site of Castle

	Projet 1	Project 2	Project 3
Project title	Management study for reconstruction the site	Reconstruction the temple	Management & Reconstruction the whole site
Involved parties	Universities and research centres, national experts and private offices	related governmental departments, national construction companies, local community	Universities and research centres, related governmental departments, national construction companies, local community, expatriates, International friends, agencies
duration	9-12 months	6-9 months	3-5 years
Raising human and financial resources	Research and governmental budgets	Prime Ministry budget, Related governmental departments, Local community, NOGs	national budget , local community, expatriates, International friends, agencies, UNESCO, International Agencies, INGOs,
Evaluation	On site visits and regular meetings and two workshops (mid and end of the study)	On regular site visits and meeting with construction parties	On site regular visits by involved supporting parties, annual workshops, media

Syrian research institutes and governmental organisations working in this domin, is working on a research project titled "Spatial, regional, and environmental planning activities linked with Disaster management and risk reduction in Syria". Some information about this work can be seen in [6,7].

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4 Formulating Disaster Risk Management Plans of Historic Buildings

4.1 Disaster Risk Management Plan for Castle Batthyany in Ludbreg, Croatia

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1. Introduction

The first mention of today's castle Batthyany in Ludbreg reaches back to year 1320, when it was referred to as the „Castrum de Ludbreg". In the centuries to follow, the Castrum has accommodated numerous adaptations and additions, while the most extensive modification of the gothic-renaissance Castrum into a baroque-type castle was conducted in 1745. Further minor changes were again introduced in the 19th century, while the most recent and extensive contemporary restoration was conducted during the 1990s.

This very brief historic overview of interventions in the today's castle Batthyany does not mention any repairs or damages due to natural or human hazards, and indeed none are omitted. There simply hasn't been any significant damages (truth be told, some misuse was timely discontinued in the late 20th century, and fortunately resulted in no permanent defect to the object), not because there wouldn't be any hazards or incidents, but it seems because the object was managed adequately, so that no disasters or crisis actually occurred.

This, however, leaves no space for slacking, as the environment, both physical and social, is changing, and new, maybe more precarious, hazards occurred in the meantime.

For this purpose, just as many other cultural goods might, castle Batthyany will benefit from Disaster Risk Management Plan (DRM Plan) devised to its measure, to become, with time, part of the comprehensive management plan for the site. This paper will briefly outline some of the key aspects of the DRM Plan for the castle Batthyany in Ludbreg, and provide questions for further consideration (Fig. 1).

Fig. 1 Ludbreg, castle Batthyany, the entrance to the castle, which hosts Ludbreg Restoration Center of the Croatian Conservation Institute (left), and one of numerous restoration ateliers in the castle (right)

2. Concept of the DRM Plan

The respective DRM Plan for the castle Batthyany will follow the UNESCO/Ritsumeikan methodology, presented at the "UNESCO Chair Programme on Cultural Heritage and Risk Management, International Training Course (ITC) on Disaster Risk Management of Cultural Heritage 2014, 9th year", organized 6-22 September 2014 by the Ritsumeikan University.

This methodology considers a cycle, including activities to be done before a disaster occurs, activities during a disaster, and also the time after a disaster. More precisely, these activities are divided into the following steps to be considered: risk assessment, prevention and mitigation measures, preparedness and response, damage assessment, treatment, and revitalization of the object/site (Fig. 2).

The DRM Plan, therefore, considers all aspects of the mentioned cycle, and it also gives consideration to specific character, needs or circumstances of the cultural heritage in question. In this respect, the DRM plan for the castle Batthyany will consider primarily fast hazards, such as earthquake and fire, and just give mention of the slow hazard, possibly resulting from the depopulation or financial constraints.

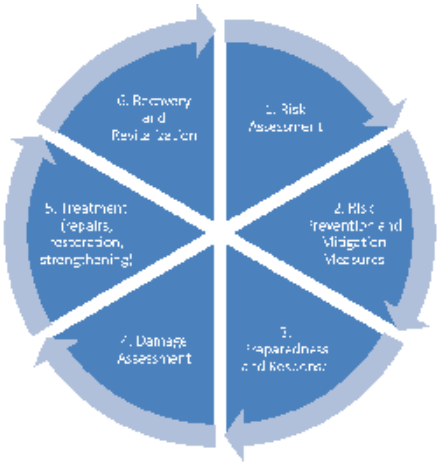

Fig. 2 Activity and improvement cycle of disaster risk management for cultural goods
Simplified, from source: UNESCO Chair Programme on Cultural Heritage and Risk Management, International Training Course (ITC) on Disaster Risk Management of Cultural Heritage 2014, 9th year, Ritsumeikan University.

3. Risk Assessment

Risk assessment requires several steps, including the determination of the following:
heritage attributes of the considered cultural good/site,

- values (and priorities) assigned to individual heritage attributes,
- sensitivity and exposure of the heritage attributes to the prevailing hazards,

and from this, ultimately, the resulting level or risks for the specific heritage attribute/value (Fig. 3).
In case of the castle Batthyany, there are four main attributes selected for consideration in this paper, and they are listed, along with their respective values (in the order of prominence) in Table 1

Fig. 3 Ludbreg, castle Batthyany, St. Cross Chapel, wall paintings (left), and art depot on the top floor of the building (right)

Table 1 Heritage attributes and related values (in order of prominence) of the castle Batthyany in Ludbreg

Heritage attributes	Related values, in the order of prominence
Architecture (Fig, 1 left)	social, historic, identity (citizens), economic, esthetic, religious
Wall paintings (Fig. 3 left)	historic, esthetic, religious, artistic
Heritage being restored in ateliers, and heritage in art depots	historic, artistic, religious, esthetic (Fig. 1 right and Fig. 3 right)
Restoration documentation about numerous heritage objects	scientific, historic, economic, social

All of the heritage attributes have historic value, but also very prominent value to the citizens of Ludbreg, who identify with this prominent object in their environment (Fig. 1 left). Furthermore, the chapel of the Castle has an outstanding religious value, and so the wall paintings therein as well (Fig. 3 left). The Castle also holds a valuable cultural heritage being currently processed or restored in the restoration ateliers (Fig. 1 right), or is temporarily or permanently stored in the Center's art depot (Fig. 3 right). Due to the nature of the restoration works and the Center acting as a "hospital" for various cultural heritage, the heritage attributes and corresponding values of these cultural goods are variable. Documentation kept at the Restoration Center is one additional heritage attribute, which requires special consideration, as, in relative terms, its high ranking values are scientific, historic, economic and ultimately social.

Prevailing risks in the wider Ludbreg region are earthquake and floods. The earthquake risks result from the geographical location of Ludbreg on two faults (Fig. 4).

The floods may either be the result of the flooding of the River Bednja, which flows cca. 100 m from the Castle (Fig. 5), or may result from the breach of the dam HE Čakovec, to the North-West of Ludbreg (Fig. 6). Damage by water may also occur due to the leakage in the Castle's piping, or due to the fire-fighting efforts.

However, the Castle is slightly elevated from the generally flat area around the River Bednja, which renders it not sensitive to any flooding of the River Bednja. Also, although Ludbreg is located just on the margin the area which would be affected by the (simulated maximum impact) breach of the dam HE Čakovec, therefore the castle Batthyany seems not to be actually exposed to that particular risk.

There are also some significant risks that primarily come from within the object, such as fire. The sources of fire may be arson, and an incident within the castle, possibly involving some of the many flammable chemicals used in the restoration process, independently, or in combination with inadequate management of various restoration, kitchen or dormitory equipment, etc.

Additionally, there is also a risk of explosion due to potentially explosive atmosphere, which may be generated in the carpenter's workshop, or by the malfunction of the gas delivery systems.

Both fire and explosions may also be secondary risks, i.e. as a result of earthquake, or other risks, which may yield structural damage to the building and piping, or impair preventive equipment or measures.

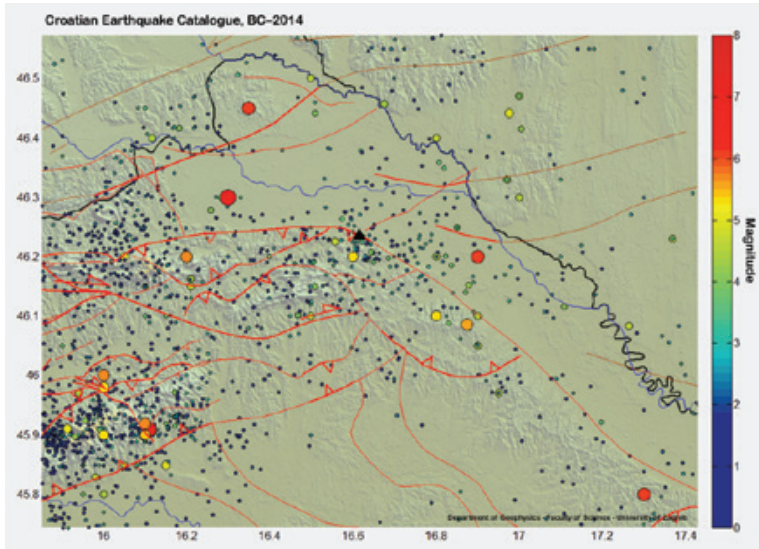

Fig. 4 Croatian Earthquake Catalogue, BC-2014; view of the wider Ludbreg area
Source: Marijan Herak, PhD, University of Zagreb, Faculty of Science, Geophysics Department, 2014.

Fig. 5 Aerial view of the castle Batthyany in the red polygon, and River Bednja flowing to the right of the Castle
Source: Geoportal, http://geoportal.dgu.hr/, 9 October 2014.

Fig. 6 Estimated maximum impact area as the result of a simulated breach of dam HE Čakovec
Source: National Rescue and Protection Directorate, 2014.

4. Risk Prevention and Mitigation Measures

Considering the heritage attributes, their relative values, as well as their exposure and sensitivity to the abovementioned risks, one may produce a set of risk prevention and risk mitigation measures for the castle Batthyany in Ludbreg.

The existing risk mitigation systems are significant, and they include adequately positioned smoke detectors, 90-minutes fire-resistance by the art depot, existence of water hydrant system, well distributed fire-extinguishers, audio alarms, and well-marked evacuation paths (for people). All the systems are regularly inspected and serviced, and are operational. The fire detectors, as well as existing movement (anti-theft) detectors, are connected directly to the remote security services company, which reacts adequately to all alarms, and starts the predetermined response procedure (Fig. 7).

However, increased risks, especially at the top floor include usage of the fully equipped kitchen and dormitory, location of the boiler room, single evacuation path, and possibility of spread of fire through the hallways due to non-fire-proof separations of various spaces and sections.

To mitigate the later risks, the proposed measures include introduction of the (electricity and water supply autonomous) water mist systems, CO-detectors in the dormitory rooms, boiler room and the kitchen, positioning of two discreet retractable ladders (on the distant side of the Castle in relation to the existing evacuation route; and also one more into the atrium of the Castle). Due to the possible need to evacuate the endangered cultural heritage from the top-floor art depot, it

would also be useful to have a pulley or a similar auxiliary effective horizontal transport system to allow evacuation of the cultural heritage items (and people, as needed) directly from the protected art depot. Such pulley or similar, could also be used in regular business as needed, and set up on demand. In case the visitors or employees have visual or hearing impairments, the alarms would need to be visual (light) as well as audible throughout the Castle, while directions for all (regular and emergency) exists could be inscribed in Braille on all the doors and handrails. With regard to the persons with impaired mobility, an evacuation chairs should be accessible in several locations around the Castle to allow adequate evacuation aid in emergency, though the main stairway. To be on the safe side, CCTV could also be installed and be available via Internet to the designated persons (outsourced security service, and internally designated staff) to be able to monitor the space at any time as required (Fig. 7).

Fig. 7 Typical layout of the castle Batthyany (top floor), with the indication of risk prevention and risk mitigation measures and equipment to benefit safety of both the people and cultural heritage
Source of the base Castle layout: City of Ludbreg, 2014.

5. Preparedness and Response

Preparedness includes three components: material, organizational and experiential. The material component assumes the existence of material means which are instrumental in adequate response and recovery (such as fire-extinguishing equipment close to the protected object, conservation and restoration materials used in emergency conservation/restoration works on the endangered/damaged cultural heritage).

Organizational component assumes the existence of organizational solutions at both local and national level, which allow for adequate response, and subsequent recovery process. This could involve the system of communication and response, which includes the evacuation of endangered people and cultural heritage away from the affected site in Ludbreg towards the redundant (receiving) centers in e.g. Šibenik, Split and Zagreb (Fig. 8), as well as incoming support from all other unaffected restoration departments of the Croatian Conservation Institute, but also from other institutions nationally. Furthermore, organizational aspects also call for adequate organization and usage of space in the vicinity of the castle Batthyany, not only in emergency but continuously at all times. This immediate surrounding is used in disasters for triage and evacuation sites, and allows safe routes outside the affected area (Fig. 9).

The third component of the preparedness involves experience, which normally results from response during past incidents, as well as from both theoretical and practical exercises, conducted internally, or even better, jointly with the other emergency response teams, which would be present in a real-time disaster (Fig. 10).

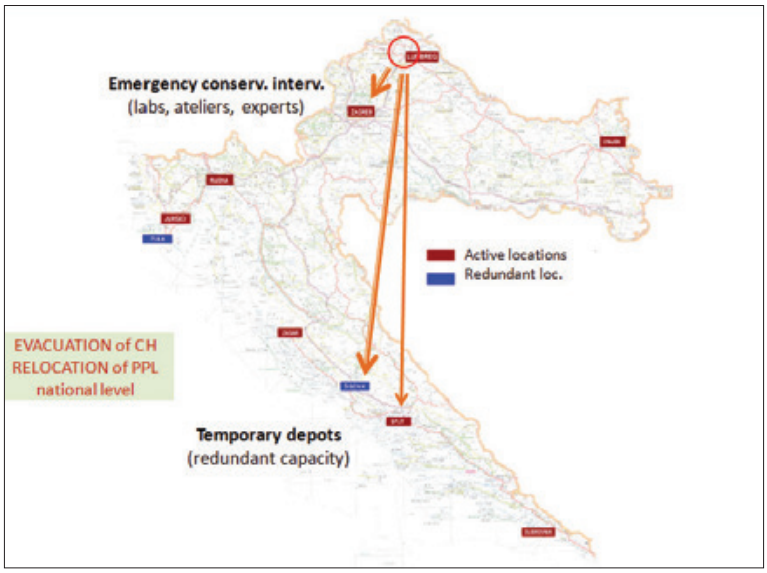

Fig. 8 Possible evacuation routes towards the redundant (receiving) locations of the Croatian Conservation Institute for both employees and cultural heritage, in case a disasters strikes Ludbreg. Image may also be interpreted as the overview of potential restoration support, which could be pooled from the other indicated (unaffected) restoration departments of the Institute
Adapted from source: Annual Report of the Croatian Conservation Institute 2009.

Fig. 9 View of the considered heritage site indicating the usage and organization of the immediate surroundings of the Castle, the auxiliary storage of reserve materials and fire-fighting equipment, as well as with the evacuation routes away from the site

Fig. 10 Joint conference by disaster management and cultural heritage experts in Zagreb (2013) adds to the networking, understanding and cooperation of cultural heritage and disaster management experts in disasters (left). Planned and executed fire-exercise (2011) for the largest Croatian restoration atelier (Croatian Conservation Institute - Zmajevac) in Zagreb was an invaluable learning experience for all, the firefighters, restorers and the management

With regard to the preparedness and response, it is important to stress the importance of the restoration documentation about the cultural heritage. According to the Croatian regulations, documentation about the cultural goods is itself considered a cultural good on its own. And this is so regulated with a good reason: documentation is a kind of a genetic code of the cultural heritage. In the case a cultural good may under no circumstances be retrieved from the disaster, or is definitely destroyed, its corresponding documentation holds record of all of its heritage attributes, by description, photographically, most recently in a form of high resolution 3D scans, though laboratory analyses and reports, and also art-historians' descriptions and interpretations. Thus, further to such detailed documentation, considered cultural good may, in the absence of the preferred original, continue to be researched, interpreted, repaired, reconstructed, or, if so decided, its facsimile produced.

Also, another important issue to address with regard to preparedness and response is the fact that the first response in disasters, even considering the preservation of the cultural goods, may commonly be provided only by the technical emergency services, orchestrated by the authorized national authorities in charge of the disaster management and relief. It is paramount that these authorities, expectedly not versed in cultural heritage affairs, at any given time have at hand a simple, easily legible and practical tool to estimate the volume of the cultural heritage potentially affected, and locations and routes for its temporary, safe displacement. For this purpose, an initial tool (using Solver in MS Office Excel program) has been developed, which may be almost intuitively operated and interpreted by any adult after a 5-minute training (Fig. 11). However, this calculation table heavily relies on thorough research and adequate inventory of cultural heritage at the national level, thus its 4/2014 version needs updating and further development, to achieve higher level of precision, reliability and usefulness.

	Raspored							LC tip A	LC tip B	LC otvoren		
Lokacija LC-a	Bjelovar	Slavonski Brod	Osijek	Požega	Sisak	Virovitica	Vinkovci	0 = ne 1 = da	0 = ne 1 = da	0 = ne 1 = da	Promet LC-a	Nedostatni kapaciteti (> K)
Bjelovar	400	0	0	0	0	150	0	0	1	1	550	950
Slavonski Brod	0	0	0	0	0	0	0	0	0	0	0	0
Osijek	0	0	100	150	0	0	250	1	0	1	500	0
Požega	0	350	0	150	0	0	0	1	0	1	500	0
Sisak	0	0	0	0	500	0	0	0	1	1	500	1000
Virovitica	0	0	0	0	0	0	0	0	0	0	0	0
Vinkovci	0	0	500	0	0	0	0	1	0	1	500	0
Nepodmirena potražnja u m³	0	0	0	0	0	0	0					

Fig. 11 Simple assistance tool to the emergency services for quickly estimating the volume of the cultural heritage affected, and proposing combination of routes and temporary evacuation locations. Solution table (left) for the Eastern Croatia disaster scenario. Corresponding geographic illustration (right). Source: Tkalec, Stanković, Cipurić, conference "Crisis Management Days", University of Applied Sciences Velika Gorica, Croatia, 2014.

6. Damage Assessment

Experiences from the recent large-scale disasters, such as the Croatian Homeland War 1991-1995, indicate that damage assessment is very sensitive and important part of the later recovery, and that it requires professional and experienced cultural heritage experts, as well as hopefully access to the documentation about the considered items and objects. It is less a matter of a form to fill in, and more of intimate understanding of the epoch, type, and individual character of the cultural heritage considered. Therefore there is little automation possible here, as the situation calls for a doctor-patient-like approach, unless the needed assessment needs be fast, on large scale, and would suffice to be approximate.

In the case of the castle Batthyany, it being only one building, and having the documentation available in different locations, assessment would be possible by any built cultural heritage team of experts with expertise in the heritage attributes determined for the site.

7. Treatment, recovery and revitalization

Treatment of the damaged cultural heritage involves moving the heritage to the safe location, applying emergency conservation measures, and ultimately restoring it, including, if possible, its return to the original site.

In the case of the castle Batthyany, distributed network of the restoration ateliers of the Croatian Conservation Institute would allow for the endangered cultural heritage of the Castle to be treated adequately at other, unaffected restoration centers in different parts of the country (Fig. 9), while sufficient redundant spaces are also available in the cities of Split and Šibenik as temporary art depots. This (although limited) system of decentralized and redundant capacities may also serve as the support to other endangered institutions, museums, archives and libraries, as well as private cultural heritage holders.

The first step in (emergency) conservation measures takes place immediately after the disaster, and this inevitably dictates further treatment. It may include conservation by freezing (e.g. of the paper documentation, or cultural heritage on paper and some textiles), if heritage items are damaged by water. Generally, any emergency conservation intervention would seeks to ensure the adequate microclimate conditions, for both damaged and endangered cultural heritage, as we as general security of the endangered heritage.

The second step assumes restoration and recovery, which is generally expensive and long term process, however in the case of the castle Batthyany, and with respect to its recent restoration, it might be manageable, given that there are sufficient resources available, which is, nevertheless, one of the main threats to the cultural heritage at hand, at this time.

8. Conclusion

The castle Batthyany in Ludbreg is a very valuable cultural heritage, which has become part of the social and economic fabric of the City of Ludbreg, its citizens, and surroundings. Its heritage attributes and corresponding values are endangered by various natural and anthropogenic fast and slow hazards.

Given it has been well researched and documented during the recent restoration of all its parts and aspects during 1990s, although there is still space for improvement, and that it is well maintained around the year, the level of risks seems fairly low. The most prominent risks include earthquake and fire, as fast risks, and imminent possible further financial constraints, which may affect its maintenance, heritage values and ultimately its survival in the course of the next century.

Resulting from “UNESCO Chair Programme on Cultural Heritage and Risk Management, International Training Course (ITC) on Disaster Risk Management of Cultural Heritage 2014, 9th year“, organized by the Ritsumeikan University, the Disaster Risk Management Plan for Castle Batthyany, will ultimately add towards further consideration and mitigation of both fast and slow risks for the castle Batthyany in Ludbreg, thereby improving the safety of the object, as well as security of the local community, and communicate measures to improve its future perspectives.

4.2 Risk Management of Gedung Sate as a Cultural Heritage

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1. Introduction

Bandung is one of historical cities in Indonesia occupied by the Dutch Colonial for more than three centuries. From the 16th until 18th century, the city was initially functioned as a small trading town where it can be axis for economic activity in West Java region. This city is located at the South East of Batavia, the capital of the nation at that period. In this time period, the colonial government expanded their agriculture plantation, especially tea and quinine, and mine materials extraction in several places around West Java, such as Lembang, Pangalengan, Garut, and etc. Along with the rapid development of trading activities, the colonial government of Dutch East Indies started to plan and develop Bandung further in the early 20th century as the center of colonial government, especially for economic, administrative, and military activities (Voskuil, 2007). From this point, many developments of buildings and infrastructure, such as settlements, public facilities, banks, government office buildings, water drainage, and etc., took place to facilitate European people working in agriculture sector around Bandung area. As a result, the principles of physical urban development of Bandung City adopted the European Neo-Classical architecture style.

The early design of Bandung was aimed to be a city of 500,000 inhabitants. Nowadays, Bandung is one of largest metropolitan city in Indonesia where it becomes the capital city West Java Province. According to the latest statistical data of Bandung, the city has expanded which makes it the center of social and economic activities for approximately 2.4 million inhabitants (Badan Pusat Statistik Bandung, 2013). After Indonesian independence in 1945, Bandung has encountered massive transformation and urbanization, from small trading town into a dense 16,000 people/km2 metropolitan area. Structural, urban land use and social changes took place due to high spatial demands for housing, transportation, workplaces, and other urban amenities. Consequently, this urbanscape changes affected the cultural heritage buildings in the old town constructed earlier during Dutch colonization era. Many of them are either used for or transformed into modern buildings and vital urban functions, including office buildings, banks, malls, shops, retail stores, and houses for workers, military offices, and other supporting facilities to accommodate the current needs. The recent development approach was mostly followed by inadequate planning control and ambiguous development efforts. Such developments often neglect not only the heterogeneity of historical city structures and the remaining urban heritages, but also their preservation efforts (Ignasia, 2008). This condition makes existing urban heritage more vulnerable and becomes risky to any natural hazards threats.

Due to its location, Bandung is prone to various natural hazard threats. Geologically, Bandung sits in a basin of alluvial sediments produced sby active volcanoes and plates in western part of Java Island. The extent of the basin is about 23,000 km^2 and located at a highland plateau of 650-700 m sea above sea level rise. There is an active fault located about 20 km north of Bandung, well known as the Lembang Fault, making Bandung City prone to severe earthquake impacts (Sagala et al 2012). One other main hazard is Mount Tangkuban Parahu, located about 20 km north of Bandung which can be source of volcanic hazards possibly striking the city, such as lahar and ash-fall. The excessive and uncontrolled land use change in the north part of Bandung, where is the conservation are for water catchment, and land subsidence in the southern part, where Citarum River watershed exists, create higher occurrences of flood in Bandung (Abidin et al., 2013). The city's density also make it vulnerable to many fire risk events, about 100-150 fire incidents occur in the city (Sagala et al 2014). Considering this condition, there is an urgent need to protect and preserve urban structures and functions from any possible severe disaster, in particular vulnerable

urban heritage buildings which are now used for critical function, such as conservation and socio-economic activities.

2. Studied Area for Disaster Risk Management Planning

This study selected Gedung Sate building as study area for disaster risk management planning. Located in the center part of Bandung, Gedung Sate is one of well-known historical heritage buildings in Bandung and it becomes landmark of the city. Its construction took from 1920 to 1924 designed by a Dutch architect, Ir. J. Gerber. He intended to set it as the main building of other 24 planned buildings for new site location of Dutch colonization office in Indonesia. However, there were only three of them -including Gedung Sate- completed successfully before the project stopped because of European economic crisis in 1930. Afterwards, it was used by Department of Public Works of Dutch East Indies until the independence of Indonesia in 1945. Then, Ministry of Public Works of Indonesia replaced its function as one of its branch offices in West Java area until 1980. Today, it is used for the office of Governor of West Java Province (Fig. 1).

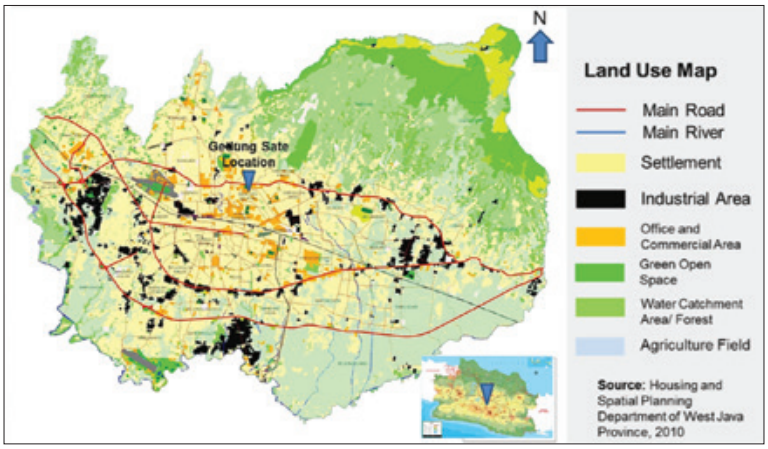


Fig. 1 Study Area Location in Bandung Metropolitan Area, Indonesia

There has been no major change of its construction structures, construction materials, and architectural design since its establishment. Gedung Sate is four stories building influenced by the combination of architectural style: European Renaissance, Indian (Hinduism Temple), Chinese (Pagoda), Islamic (Mosque), and Indonesian (Sundanese traditional buildings). It has a unique decoration of satay stick consisting six fruit ornaments on the top of its roof which the name of Gedung Sate comes from. The construction materials were limestone, andesite rock, bricks, and ironwood. The building was constructed by reinforced concrete technology making it resists to earthquake. Gedung Sate was built on 27.000 m^2 of land space, 10.000 m^2 of built area and consisting of basement 3.000 m^2, first floor 4.000 m^2, second floor 3.000 m^2, and tower floor 205 m^2. Nowadays, Gedung Sate is surrounded mainly by commercial service as well as private and government office use while middle-income residence with European classic architectural style can be found in the south part of the buildings.

The building has been hit by several major earthquakes, such as Tasikmalaya Earthquake 2009 (7.3 Richter scale), Pangandaran Earthquake 2006 (6.8 Richter scale), and Yogyakarta Earthquake 2009 (5.9 Richter scale). Volcanic ash fall produced by volcanic eruptions in West Java region also struck the building and disrupted activities inside the building, such as Mount Tangkuban Parahu (1929), Mount Galunggung (1980), and Mount Merapi (2010). In recent years, the surrounding area of Gedung Sate is frequently flooded due to drainage problems. However, no substantial damage and losses to Gedung Sate due to those events was reported (Fig. 2).

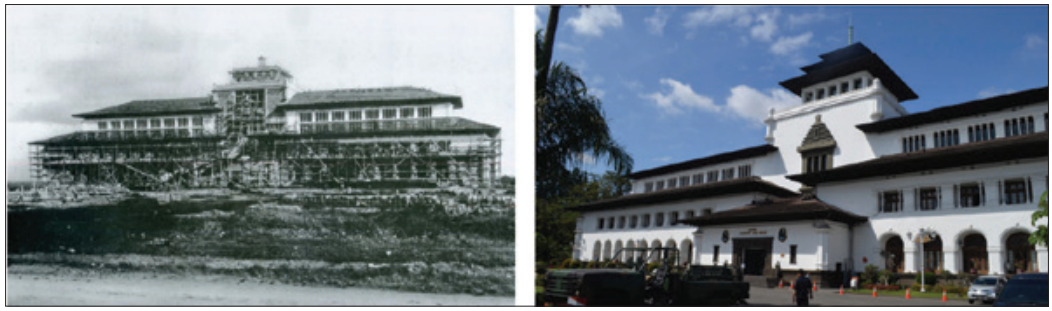
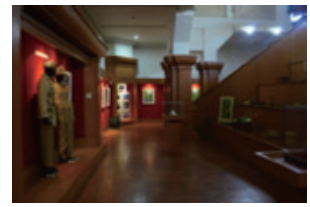


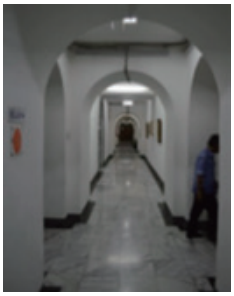
Fig. 2 Gedung Sate When Constructed (1924) and Gedung Sate Today (2014)

3. Main attributes and values of the Study Site

Based on from observation, in-depth interview with building management spoke person, and existing literature, the main attributes and values of Gedung Sate can be categorized as described in table 1 below. One attribute can also involve more than one value, such as the Satay and Pagoda tower. It has architectural value that gives a unique architectural style combination between Indonesia and Chinese style which are rare to be found in Indonesia. In the other side, it contains of social value that has become the symbol of the province (Table 1).

Table 1 Main Attribute of Gedung Sate

Attribute	Type	Associated Value	Picture
Satay and Pagoda Tower	Immovable Tangible Cultural	**Architectural:** the Pagoda Tower is one of its kind in Indonesia. Social: The first building that used this shape of tower and therefore it has become the symbol of the province.	
Collection	Movable Intangible Cultural	**Cultural:** It has several collection of West Java Province, from old weapons, fabrics, puppets. Social: Visitors can come to see this place and learn about the cultures of West Java (Sundanese) People. However, only few visitors know this place.	
Wooden Wall	Immovable Tangible Cultural	**Architectural:** Wooden wall adds the historical value of the building makes the building looks beautiful	
Library	Movable Intangible Cultural	**Cultural:** Old archives and documents of West Java Province, such as books, maps and photos Social: Visitors can come to see this place and learn about the history of West Java Provinces	

Bell	Movable Tangible Cultural	**Architectural,** the bell is quite unique and rarely existed in Indonesia. The material is from mix of Copper and Iron. **Social:** this is one of the attractions that people want to see when they visit Gedung Sate.	
Basement Corridor	Immovable Intangible Archi-tectural	**Architectural:** Old european, renaissance style **Social:** Visitors can come to see this place and learn about Old Dutch Architecture.	

Source: Field Observation (2014), Interview (2014), and Regional Secretariat of West Java Province (2012)

4. Vulnerability and Potential Impact of the Study Site

Vulnerability assessment is conducted to determine areas that are vulnerable to natural (and/or human induced) hazards that will most likely be damaged and need to be redeveloped after a disaster. It involves three categories of vulnerability, including physical, social, and economic. Later, it can be used as consideration to target which structures, components and infrastructure of the buildings should be restored back to pre-disaster condition or which ones should be modified through construction practices, local disaster management mechanism or design practice to reduce future hazard impacts.

Physically, Gedung Sate has several vulnerability components. In term of the whole physical condition of the buildings, it consists of some materials which are combustible, such as wooden wall materials, wooden-made roof, textile-made curtain and wooden-made furniture. Mostly, rooms in Gedung Sate, such library and government officers' room are used to store valuable collection, such as government documents or archives, old collection (books, maps, paintings, and documents), etc. The tower is also made from combination of wood and copper, prone to fire and earthquake.

There are some social and economic vulnerability indicators that are considered as potential source of tangible and intangible impacts after disaster events. It is estimated that 1,122 people (data taken in 2013) working in the building are at risk in case of hazard occurrence during the day. Tourists can be potential loss since they are free to visit Gedung Sate during working hours. It is difficult to monitor them in the building because there is lack of mechanism to monitor and protect them in case of hazard occurrence during their visit. Valuable items inside the building can be potential loss in term of social and economic vulnerability, such as government documents or archives, computers, old collections (books, maps, paintings, and documents), furniture, and etc. Nearly 1,122 public servants cannot work and public service is stopped for temporary time when potential hazards occur.

It is also important to take into account the vulnerability of physical environment near Gedung Sate. There are some settlements near Gedung Sate that can be vulnerable to fire. As observed by Sagala et al (2014), Bandung has experienced large number of fire events.

5. Existing Disaster Management in the Study Site

The building management officers of Gedung Sate arrange evacuation plan in order to prepare actions required for people inside the building during emergency time. They have created evacuation maps inside buildings equipped by evacuation direction signage in each corridor of the building. They also set three parking lots in eastern, western, and northern part of the building as meeting points for evacuation. The head of building security is responsible to turn on siren and lead evacuation during emergency time. The public servants also have been trained once in a simulation drill for fire and earthquake in 2008. Although the building seems to be well-prepared for evacuation, however, according to observation results, there are still shortcomings that have to be considered. First, the evacuation map is not displayed on any spot inside the building. Secondly, the evacuation direction signage is too small to be recognized and to be read.

The building has some equipment built for monitoring any source of possible security and hazard threats over time. It is equipped by CCTV (Closed Circuit Television) equipment in several spots of the building. Since it is used by the public authority of West Java who has responsible to inform to public any natural hazard occurrence in the region, such as volcanic and seismic activities, it has also monitoring equipment linked to monitoring system set by national agencies who responsible to generate hazards occurrences information. Both are set in a room inside the building where security officers work.

To prevent from fire risk, the building management officers have prepared several fire protection tools. They provide fire extinguishers in each room as well as corridors and two firefighting vehicles parked in the south parking area. Nevertheless, the building is still not well-equipped by full fire protection tools to deal with larger fire occurrence inside, such as fire sprinklers and hydrant system. The existing hydrant system has been embedded in the building construction since its establishment but now it does not work functionally due to old technology left by Dutch colonial government. Today, it becomes one of displays shown for increasing tourism attraction.

According to the interview and observation activities, the building management officers has not considered yet mitigation and recovery planning that can be guidelines for actions taken before and after emergency phases. Currently, conservation and maintenance efforts are conducted annually but they are limited to beautify the buildings, such as (1) Repainting the walls or changing floor tiles, (2) Adding/fixing furniture for office purposes, and (3) Replacing the building parts when it is damaged or needed. There is no existing policy or efforts provided by the building management officers for mitigation, such as replacing combustible materials, protecting efforts to save important valuable collections, adding fire protection tools, etc. There is also no pumping or internal drainage system. There is still lack of guidance on how the building will be recovered because of disasters.

6. Hazards Forecast

Floods may occur during heavy rain situation since the drainage around the site is badly maintained. Even now, heavy rain could cause the flooding on the roads. There is probability that flooding occurs in the area and inundates the ground floor which has a library (old books, old maps), offices, building mechanics) since the building is located relatively lower than its northern area. There is no pumping system installed and any measure to tackle water coming in.

Fire can be ignited from come from any sources, such as external: settlements, other buildings, arson, etc. and internal: kitchen in basement, mechanics, and electricity. The surrounding of Gedung Sate is covered by high density settlements and office which can be source of fire spread. Gedung Sate is also risky to be targeted by arsons since its government office. Inner activities inside the building can ignite fire such as a fire accident in the kitchen and a short circuit by electronic utilization. Fire could start to ignite and burn wooden wall and combustible materialts in the basement. Fire could spread to the 1st floor where Governor's and office rooms on the 1st floor and 2nd floor are located as well as collection in the third floor. Flood and earthquake could be

primary hazard that could generate fire from short circuit accident.

7. Proposed Flood and Fire Mitigation Measures

For mitigation measures, there are several strategies that should be considered and proposed as follows:

Operational measures

① Providing water tank that can store flood water and channel it to lower area.
② Installing water pumping system connected with water tank.
③ Assigned team for pumping maintenance and in case of flooding.
④ Assigned team for taking most valuable collection, such as maps and old books.
⑤ Providing active fire hydrant and sprinkler system that be used to fight the fire.
⑥ Assigned Building Disaster Management team for hydrant maintenance and in case of fire.
⑦ Calling for the police and firefighter team when needed.
⑧ Appointing an officer who is responsible for observing flood occurrence and switching off the electricity when needed.
⑨ Conducting flood and fire drill and assignment for public servants.
⑩ Involving local departments, such as Public Work, Archeology, Disaster Management Agency, Environmental Agency, etc., for protecting the building.
⑪ Drainage construction and maintenance.
⑫ Moving some valuable collection to the 3rd Floor.

Strategical measures

① Urban planning. The mitigation measures need to be integrated with the current urban planning so that the hazard and vulnerability elements from external can be eliminade beforehand. For example, there is a need to have a coherend between the need of accessibility to Gedung Sate to be accommodated in the urban planning and detailed urban planning and design.
② Local Enactment, Policy. Local enactment is needed to support the framework, strategy and budgetting. This serves as an umbrela for coordination among the stakeholders. Currently, Bandung already has a local act on cultural heritage preservation. National law on disaster management also exists. Nevertheless, the inclusion of cultural heritage on the disaster management at local level do not exist and need to be issued.

8. Proposed Emergency Responses

In order to have a functioning emergency response, there is a need to establish emergency response team. This team consist of stakeholders of all institutions from local level to national level. Currently, the integrated system that connects with a wider stakeholders is not available at Gedung Sate. On site, when there is a disaster, there will be emergency manager to take a role to initiate the emergency condition. The role of this person also as supervisor and vocal point with the larger system, such as external aid from the city. Considering the existing management system, there is a need for City Mayor that can play for major role to coordinate during the disaster. Its role can give significant command for deploying immediate resources needed to solve the problems. The proposed emergency response managerial organization is shown below. In order to prepare for any damage or loss estimation in the future, database inventory has to be conducted immediately. Database can be stored in digital format stored at cloud storage (on line) to make sure it is not affected for any damage if a disaster occurs (Fig. 3).

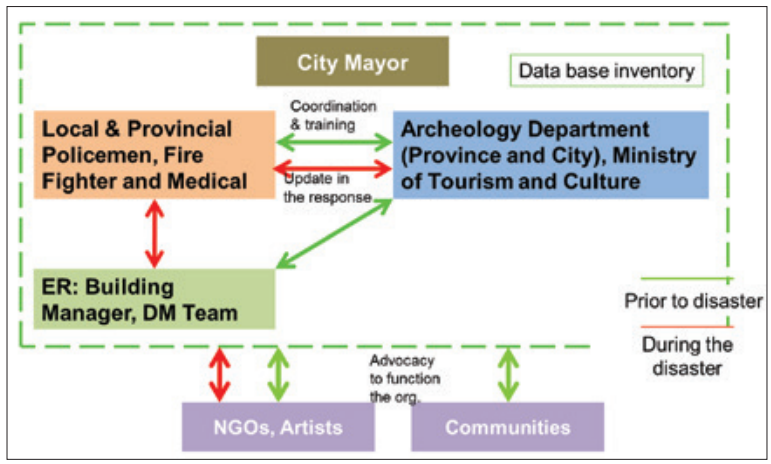


Fig. 3 Emergency responses organization chart

For emergency plan, the following standard operating procedure:

① After a fire alarm sounds
② Call Emergency Response Team
③ Office Manager check fire panel to determine the location and call the nearest person to assess the need to evacuate the building.
④ Office Manager verifies if evacuation is needed.
⑤ Every room must be checked to ensure that all people safely exit.
⑥ Reassure visitors will be safely evacuated.
⑦ Everyone leaving the building must meet in the temporary evacuation shelter.
⑧ Manager ensures all employees are accounted for.
⑨ Once everyone is evacuated, the building is not to be re-entered.
⑩ In case of fire, call: 113 for fire, call 022-7800166 for police and Ambulance 118.
⑪ Fire truck/fire fighters come from the south east of the City.
⑫ Paramedic to take care injured people because of smoke, fire, and injury.
⑬ Police will close surrounding roads to avoid chaos and crowds to see the scene.

9. Recovery Planning

As a disaster sometimes unavoidable, it is important to make a recovery planning before hand. In this proposal, three terms of recovery planning are proposed.

Short Term:

- **Baseline Rule:** Restore to the condition when it was built in 1920, with the approached taken by Dutch Architects. Consult with building plan
- **Team Organization:** Activate the team organization, divide the tasks, and make a plan of recovery in term of technique, materials and budget
- **Material and Storage.** Store the movable items at a designated place. Used old materials that are still good

Medium Term:

- **Clean Up & Preparation for Construction:** Clean up of the area (takes about 3 months). Construction of wall to start the construction work.
- **Structure.** Reconstruction of the structure (1 – 1.5 years).
- **Roof.** Used the same or similar materials with and ability to withstand fire for about 10' (6 months)
- **Painting.** Painting with normal color (1 month)
- **Installment of disaster mitigation tools** to protect the building. (Conducted while making the construction → Collaboration Public Work and Fire Fighting Dept). 8 Fire extinguisher at each floor. Water Sprinkler that covers all the floor. Fire hydrant. Water storage. Disaster Drill with DM

team and also all officers

Long Term:

- Integration with Development Planning so that other emerging threats will not increase the risks to the sites.
- Infrastructure provision that supports the DM system in the CH building. Provision of back up system in case of the main infrastructure is collapsed.
- Taking notes of all lessons learned about the recovery process.
- Consider and make a plan for other types of disasters: earthquakes, volcanic eruptions.
- Securing financial sources for damage of CH in the City, either through local budget or collaboration with private sources.
- Strengthening coordination and training with other line departments to take CH into considerations in term of their sectoral planning and developments.

10. Conclusion

This paper shows the importance of considering cultural heritage in the disaster management systems. The current system has not treated cultural heritage as important entities and specific in the disaster management systems. This situation is still common in Indonesia. Therefore, this paper lays out some important references for Indonesian cases of cultural heritage disaster management. In Bandung City, where the case study is selected, there are about 100 heritage buildings that are prone to many disasters. Further analysis on how preparation to deal in building resilience to these sites and buildings are needed urgently.

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4.3 Government Buildings Historic Reserve - Wellington, New Zealand

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1. Introduction

The Government Buildings Historic Reserve is located within the parliamentary precinct of New Zealand's capital city, Wellington. The building was constructed in 1876 - an important turning point in New Zealand's political history. This was the year that provincial governments were abolished and a central government was established. The building was designed to provide the office space for the entire public service as a result of this change[1)].

The building is constructed on reclaimed land and built almost entirely of wood. This was primarily a cost saving measure; however the final design resulted in a building that had the appearance of an Italian stone palace. Built on four levels and measuring 80m x 50m, it is New Zealand's largest and grandest wooden building. It is an outstanding example of New Zealand's architectural heritage and one of the great wooden buildings of the world (Fig. 1).

The last government department vacated the building in 1994. The building underwent a $29,000,000 (NZD) restoration project which was managed by the Department of Conservation (DOC). A new tenant for the building was found with the Victoria University of Wellington Law School (VUW). The building continues to be managed on behalf of the New Zealand public by DOC.

Fig. 1 Government Buildings Historic Reserve

2. Attributes and values associated with the site

The Government Buildings sits majestically on its own block of land on the main street of Wellington's central business district. It is directly opposite the New Zealand Parliament Buildings. Due to the architectural design, the exterior has an appearance of an Italian stone palace, whilst the building is surrounded by an attractive garden of rare, native New Zealand plants.

The interior of the building is simplistic in layout but has been made aesthetically pleasing by the use of native Kauri timber throughout. The hanging staircase (Fig. 2), and plaster detailing is also a highlight of the building's interior.

The setting, architectural design and the extensive use of native timbers provide the main attributes and point of difference of this building. The scale and use of timber throughout its construction gives the building a high aesthetic and technical value. The nature of the buildings history to New Zealand's public service, policy and legislation, gives the building a high heritage value also.

Fig. 2 Hanging Staircase Government Buildings

3. Risk assessments

New Zealand is particularly prone to the effect of natural disasters due to its location across two major plate boundaries making the islands tectonically active. A volcanic zone exists through the central North Island and earthquakes are a realistic threat anywhere in country with approximately 1500 magnitude 4.0 earthquakes or above every year[2)].

Wellington is at particular risk to earthquake due to the extent of fault lines running through the region and city (Fig. 3)[3)]. The Wellington region is regularly shaken by small and medium sized earthquakes. Large (magnitude 7+) events are thought to occur once every 500 years and very large (magnitude 8+) events every 1,000 or more years. A large or very large earthquake on a fault in the region would result in deaths, injuries and considerable disruption to lifelines and infrastructure. Earthquakes are the highest risk hazard in the region due to the potential for catastrophic damage.

Associated with the earthquake risk is liquefaction. Much of the coastal areas around Wellington City have been built on reclaimed land. This has the potential to shift and cause liquefaction over a large area of the Wellington central business district (Fig. 4)[4)].

As New Zealand is an island in the South Pacific Ocean the country is at risk from tsunami generated from either vast distances or locally. This risk is however generally underrated. Evidence suggests that the New Zealand coastline is hit by a tsunami of a wave 1m or more twelve times every 100 years. Three events since European settlement have exceeded 10m including a locally generated tsunami that hit Wellington in 1855 [5)].

Locally sourced tsunami for Wellington could be triggered by the direct effect of earth movement by a seismic event or indirectly by the movement of sediment causing a landslide in the Cook Strait underwater canyons. A locally sourced tsunami, while more unlikely to occur, presents a higher risk because of the major consequences of such an event. A distant source tsunami (e.g. from around the Pacific) is more likely but the consequences are likely to be less (Table 1, 2, Fig. 5)[6)].

Fig. 3 Wellington Regional Faultlines

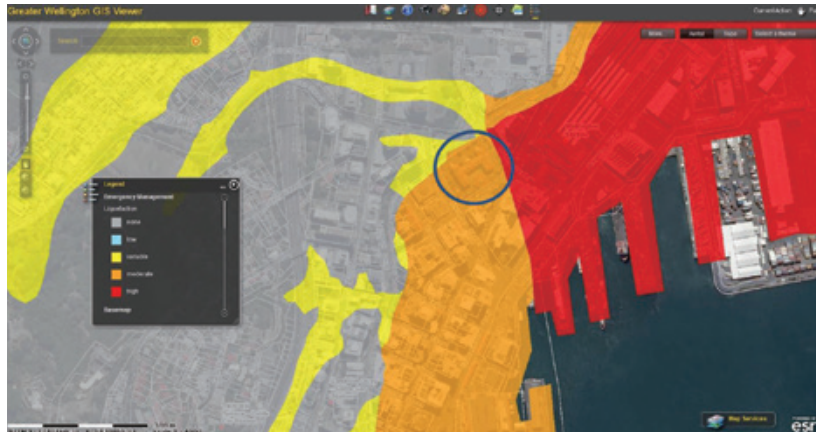

Fig. 4 Areas prone to Liquefaction

Table 1 Summary of Major Events – Wellington Region

M 6.6, Lake Grassmere, 16 August 2013 — This earthquake followed the magnitude 6.5 Cook Strait earthquake on 21st July. It caused damage to buildings on both sides of Cook Strait
M 6.5, Cook Strait, 21st July 2013 - This earthquake followed two earlier shakes of magnitude 5.7 and 5.8 in the previous two days. It caused damage to buildings on both sides of Cook Strait.
M 7.1, Inangahua, 24 May 1968 — The 1968 Inangahua earthquake caused widespread damage and was felt over much of the country.
Wahine Storm 10 April, 1968 – Storm lashed Wellington with the loss of the overnight ferry to Christchurch – Loss of 53 lives. Significant damage to buildings and infrastructure in Wellington
M 7.0, Wairarapa II, 2 August 1942 — The shock that struck the Wairarapa Region on 2 August was nearly as severe as the disastrous 24 June earthquake 5 weeks earlier.
M 7.2, Wairarapa I, 24 June 1942 — This earthquake severely rocked the lower North Island on June 24 1942, causing extensive damage to local buildings.
M 7.6, Horoeka, 5 March 1934 — The 1934 Horoeka (Pahiatua) earthquake shook the lower North Island on 5 March 1934 and was felt as far away as Auckland and Dunedin.
Wairarapa tsunami, c.7m wave into Wellington harbour, 23 January 1855
M 8.2 - 8.3, Wairarapa, 23 January 1855 — The 1855 earthquake is the most severe earthquake to have occurred in New Zealand since systematic European colonisation began in 1840.
M 7.4 - 7.7, Marlborough, 16 October 1848 — The earthquake that shook Marlborough on Monday, 16 October 1848 was the largest in a series of earthquakes to hit the region that year causing damage in Wellington.

Table 2 Risk Analysis for the Government Buildings

	Major threat	Med threat	Low Threat
Earthquake	X		
Regional /distant Tsunami		X	
Localised Tsunami	X		
Storm		X	
Fire	X		
Civil Unrest			X

Fig. 5 Tsunami Risk Zones

4. Vulnerability of hazards to the Government Buildings Historic Reserve

Earthquake

A major earthquake has the potential to create mass movement due to the buildings proximity to fault lines and its location on reclaimed land. This can cause the building and/or building piles to twist and move resulting in damage to walls, floors, stairwells and the roof. This in turn could compromise the integrity of the buildings wiring, plumbing and fire sprinkler systems. A 6.5M earthquake in 2013 resulted in large amounts of superficial damage to plaster surfaces throughout the building (Fig. 6, 7) and resulted in repair costs of over $200,000 NZD.

Fig. 6 Earthquake damage 2013

Fig. 7 Plaster damage from Earthquake 2013

Tsunami

The Government Buildings is within a low lying area of reclaimed land and would only need a tsunami wave height of 3.5 -4 m before it reached the building. A tsunami of this height or greater would have the potential to damage the exterior and interior of the building. It could also flood the basement, resulting in significant damage to the sprinkler valve control room and the diesel sprinkler pump (Fig. 8). In this scenario the building becomes exposed to a significantly increased risk of fire.

Fig. 8 Government Buildings - Sprinkler Pump and Control room

Fire

The risk of fire to the Government Buildings is very high given the extent of wooden fabric throughout the building. This timber is almost 140 years old, very dry and very combustible. Electrical damage, cigarettes and arson are the main potential cause of fire to the building. Fire protection to the exterior of the building is reliant on the availability of professional fire fighters as there is no automated external fire fighting equipment on this site.

The outbreak of fire as a result of damage brought about by either an earthquake and/or tsunami is a high risk threat, with the potential to cause the total loss of the building. The integrity of the building is reliant on the fire control sprinkler system remaining operable. Inundation of water into the basement area as a result of a tsunami or flooding would leave the building highly exposed to damage or total loss by fire.

5. Mitigation

Mitigation measures for the Government Buildings require technical planning and long term timeframes to allow for the allocation of financial budgets for high cost protection measures.

Close communication and ongoing commitments to a positive relationship with the tenant of the building is required where mitigation work involves any form of construction as this activity could interfere with business continuity for the university.

A commitment to heritage management in the event of a disaster will be needed with emergency services and regional civil defence teams when developing a disaster risk management plan for the site (Table 3).

Table 3 Mitigation measures for the Government Buildings Historic Reserve

Description of measure	Term	Partners	Cost	Other points to consider
Technical Measure – Research options and implement the moving of Sprinkler control room. (either by stand alone structure or moving to another higher part of the building)	Long	DOC University (VUW) New Zealand Fire Service Wellington City Council	High (but cheaper than restoring the Building)	Rules around the construction of new structures within a heritage zone
Develop a Disaster Risk Management Plan	Medium	Department of Conservation (DOC) Victoria University (VUW) Emergency Services and Civil defence staff	Low	Relationship building will be required
Develop a response plan that can be decentralised to adequately trained personal outside of the region	Medium	DOC Civil Defence	Med	In the event of a major disaster core work may need to be done from people outside the region
Compartmentalise the building to include firewalls to prevent fire from spreading	Medium	DOC VUW	Med	Seek professional advice from Fire engineers
Operational – Maintenance and Monitoring. Shifting battery to higher location and ensure integrity of fire protection system is maintained	Short	DOC	Low	

6. Preparedness & Response

The Building Act 2004 requires the Government Buildings to have a number of protection systems due to its size and the number of people that use the building at any one time. The diagrams in Fig. 9 - 11 outline the range of equipment on site and the designated fire escape routes.

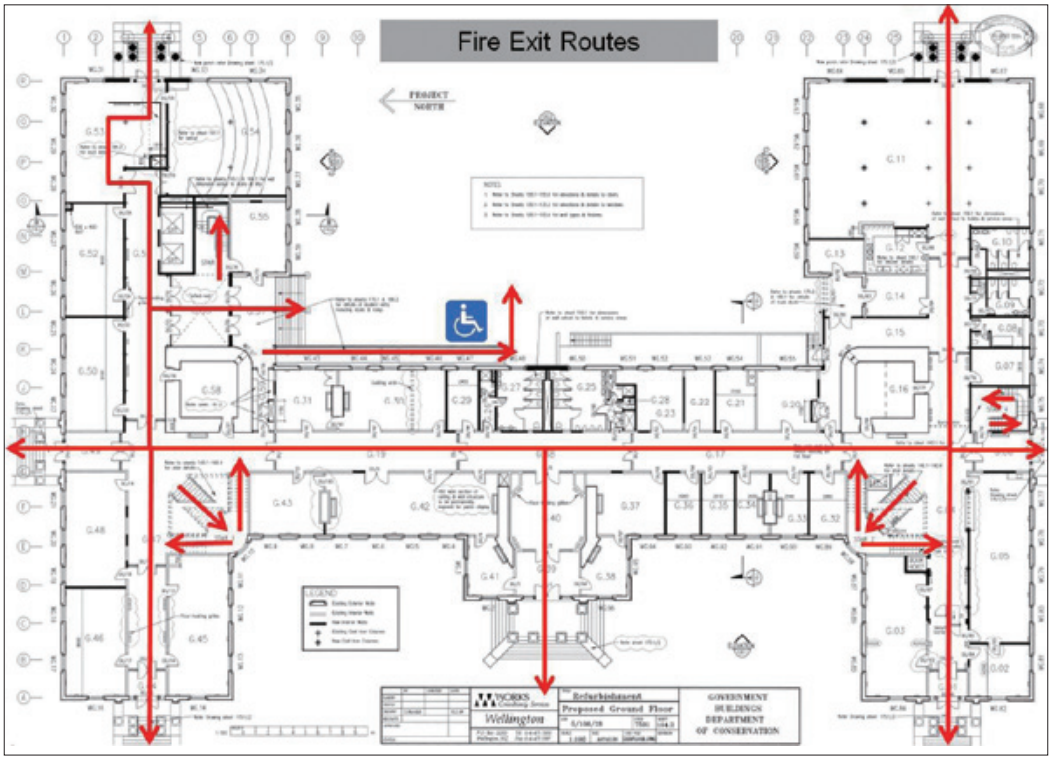

Fig. 9 Fire Escape Routes

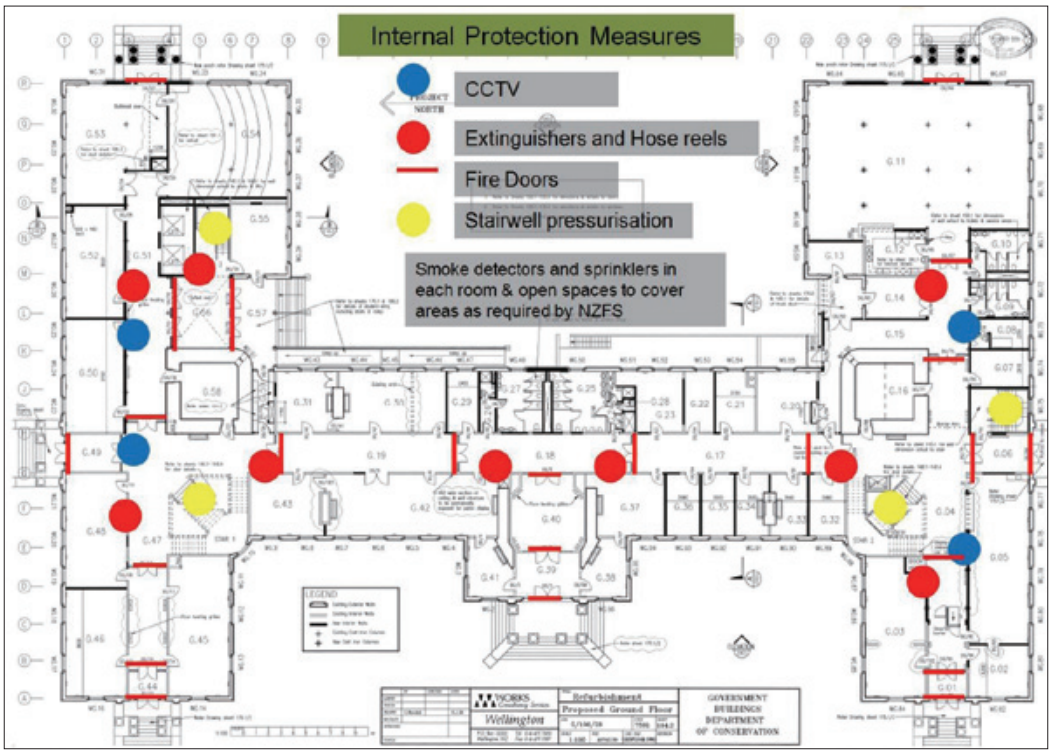

Fig. 10 Fire protection systems

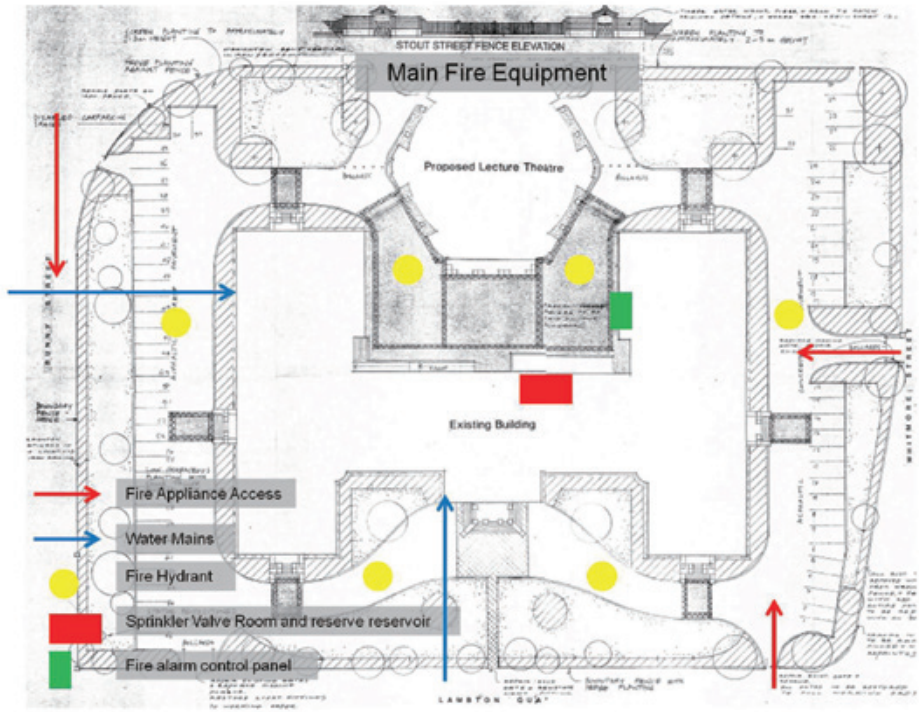

Fig. 11 External Fire Equipment

It is the legal responsibility of the Department of Conservation, as the building owner to ensure that these facilities remain in operational condition and maintained appropriately. To ensure this happens, an independently qualified person is contracted to confirm the maintenance has taken place and the required systems are operating properly.

The tenant also has a responsibility to practice fire drills and ensure that staff and students using the building are well practiced for a real event.

In the event of a regional emergency it is quite possible that emergency services may not be able to get to this site in a timely manner. In this situation the automated systems would be relied upon and the use of manual systems would only be used if the environment is safe to do so.

It will be fundamental that regional emergency managers become familiar with the concept of protecting heritage values in response to emergencies for an appropriate response to take place. This is so that decisions made in the immediate period after a natural disaster will not further compromise the building. This requires the development of a relationship with the civil defence response teams and being integrated into these the teams before a disaster strikes.

7. Recovery

In the event of significant damage to the Government Building Historic Reserve, recovery would need to address immediate, short and long term goals.

The immediate focus requires making the site safe, and looking out for the immediate needs and welfare of those that use the building.

Immediate inspections by engineers and specialist conservation teams will be used to prevent any further loss of the buildings fabric.

Longer term recovery would require the redevelopment of the Disaster Risk Management plan to incorporate any new information on the buildings response to the current disaster, and research appropriate methods for repair. Securing and allocating budgets for repair and gaining the correct consents could all take lengthy periods particularly if re-zoning laws come into effect.

8. Conclusions

New Zealand, specifically the Canterbury region has suffered significant heritage loss as a result of earthquakes in 2010/2011. Producing Disaster Risk Management Plans for specific heritage sites such as the Government Buildings Historic Reserve will help identify areas of risk and suggest methods to mitigate these risks with the overall aim of reducing the loss of heritage in disaster situations.

Before this can happens more work needs to be done to incorporate heritage protection into regional civil defence response plans.

This can only be done if heritage professionals and managers engage with emergency management teams, so that heritage values and needs can be understood before a disaster strikes. It is therefore essential that heritage professionals are part of these teams by being engaged with training and assisting in the development of response plans.

The introduction of the National Landmarks List as part of the Heritage New Zealand Pouhere Taonga Act 2014, sets up the requirement for significant heritage owners to produce Disaster Risk Management Plans. As this legislation is adopted it will help in bringing the two professions together.

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4.4 Disaster Risk Management for Vimanmek Palace and Museum

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1. Introduction

Upon his return from Europe in 1897, King Rama V (1868-1910) used his personal money to purchase orchards and paddy fields between Padung Krungkasem Canal and Samsen Canal for the construction of a royal garden which he named "The Dusit Garden" (Fig. 1).

The first permanent residence in the Dusit Garden was Vimanmek Mansion, built In 1900 by royal command of king Rama V. The King had the Munthaturattanaroj Residence in Chuthathujrachathan at Koh Sri Chang, Chonburi, dismantled and rebuilt in the Dusit Garden under the supervision of HRH Prince Narissaranuwaddhiwongse. The celebration for the completion of Vimanmek Mansion was held on March 27,1901. King Rama V then moved his residence from the Grand Palace to stay permanently at Vimanmek Mansion for five years until the completion of Amporn Satarn Residence in 1906 where he lived until his death in 1910, Vimanmek Mansion was then closed down and members of the royal family moved back to the Grand Palace.

Near the end of his reign, King Rama VI (1910-1925) gave permission to Her Majesty Indharasaksaji to stay at Vimanmek Mansion. After the King's death, she moved to stay another residence in Suan Hong compound north of Vimanmek Mansion and the Mansion was closed (Fig. 2).

King Rama VII (1925-1934) renovated the Mansion several times. For example, he ordered the installation of new electrical wires and the repair of columns of the main pier at the artificial lake In the garden. But starting in 1932, Vimanmek Mansion was used only as a storage place of the Bureau of the Royal Household.

In 1982, on the auspicious occasion of the Bicentennial Anniversary of Bangkok, Her Majesty Queen Sirikit, who had discovered that Vimanmek Mansion, with its elaborate architectural style was still intact, asked permission of His Majesty King Rama IX to renovate the Mansion for use as a museum to commemorate King Rama V by displaying his photographs, personal art and handicrafts, and to serve as a showcase of the Thai national heritage for future generations.

Fig. 1 Vimanmek Mansion – Bangkok, Thailand

Vimanmek Mansion is the world largest golden teakwood mansion with its elaborate architectural style reflecting a western influence. The building has two right-angled wings, each wing 60 meters long and meters high, and is three-storied except for the part where King Rama V resided, which is octagonal and four-storied. Although the ground floor is brick and cement, the upper floors are built of beautiful golden teakwood. Altogether there are 31 exhibition rooms, with the bedrooms, the throne room and the bathrooms maintaining the atmosphere of the Thai past. Some display rooms house exhibitions of Thai art including silverware, ceramics, crystal ware, and ivory (Fig. 3).
Besides Vimanmek Mansion and Amporn Satharn Residence in the compound of Dusit Garden (or Dusit Palace as it was later renamed by King Rama V), King Rama V allocated plots of land for the construction of residences for his consort, princesses, and Other wives. He also named gardens, canals, gates and roads after ancient Chinese ceramics (commonly called "Khrueng Kirn Tung"), which were very popular at the lime. Thus, the residence that belonged to HRH Srisawarindhira was named Suan Hong Residence (Swan Garden Residence), These residences located north of Vimanmek Mansion have been turned into museum buildings and a hall for royal coaches on show to the public (Fig. 4).

Fig. 2

Fig. 3

Fig. 4 Vulnerabilities

2. Disaster risk analysis - Fire

Fire is one of the devastating agencies in museums and similar institutions where organic materials such as manuscripts, textiles, art objects and natural history specimens are present. One must take all precautionary measures to contain fire and therefore avoid fire. One must know the elements of disaster preparedness to avert fire, to safeguard objects during fire and salvage activities after fire. The various elements of disaster preparedness are:

1. before a disaster
2. during a disaster
3. after a disaster.

Fire Safety

Fire is one of the major devastating agencies, which completely destroys objects, both organic and inorganic, within a short time. Even metallic objects such as lead or tin will be damaged by fire. Fire safety is an important aspect to be looked after. In addition to meeting environmental standards, institutions such as museums, archives and libraries should meet fire safety standards for the protection of art crafts.

Causes of Fire

Fire in a museum can be caused by various factors:

1. electrical and mechanical factors, due to failure of air-conditioners, over-loading, etc.;
2. chemical factors, due to the use of chemicals, paints, etc., in the galleries;
3. human factors, such as smoking or deliberate lighting of fires.

3. 2011 Flooding in and around Bangkok

Vimanmek Mansion located on Samsen Area and is very near Chaophraya River .As floodwaters drained southwards from Ayutthaya, Bangkok was becoming seriously threatened by mid-October. In Pathum Thani Province bordering Bangkok to the north, continuous efforts to reinforce and repair sandbag flood walls were undertaken to prevent the Chao Phraya and Rangsit canal from overflowing into Bangkok. Several districts in eastern Bangkok which lie outside Bangkok's flood wall, as well as parts of the surrounding Nonthaburi, Pathum Thani, Chachoengsao and Nakhon Pathom Provinces, became flooded as water was diverted from the Chao Phraya to the Nakhon Nayok River and outlying canals.

As flood barriers in Pathum Thani failed, even more industrial estates as well as suburban residential areas became flooded. Parts of the Pahonyothin highway leading out of Bangkok became

inaccessible, causing severe traffic jams on alternative routes. Disruption of a barrier protecting the Khlong Prapa water supply canal early on 20 October allowed floodwaters to enter the canal and rapidly flow down to Samsen (Vimanmek Mansion's location) in central Bangkok, overflowing and flooding several areas along the banks. Although the breach was controlled, residents panicked and have illegally parked cars on flyovers and parts of the elevated expressway.

The Chao Phraya River watershed drains an area of 157,924 square kilometres (60,975 sq mi). This entire area drains towards Bangkok and eventually empties into the sea. The Chao Phraya River itself, and pumping stations around Bangkok drain approximately 420,000,000 square metres (4.5×10^9 sq ft) per day. However, the releases from the dams upstream of Bangkok coupled with additional rainfalls, led to estimates that 16,000,000,000 cubic metres (5.7×10^{11} cu ft) of flood waters must be drained. This flow that headed toward Bangkok equates to 16 cubic kilometres (3.8 cu mi). Thailand's Royal Irrigation Department predicted, provided there is no new rains, it would take 30 to 45 days for this amount of water to get to the sea.

Until the water flows out to sea, it must go somewhere. This meant flooding in any unprotected low lands. The amount of land inundated, and the height of peak flood waters has been difficult to project for three reasons (Fig. 5).

- The exact amount of flood water flowing towards Bangkok was an estimate.
- Flood waters into the Bangkok area didn't arrive all at the same time.
- The amount of land area that flood waters can occupy before reaching the sea is variable depending on how well barriers hold.

Fig. 5 Training, Awareness , Preparedness and response

4. Disaster Preparedness Plan

Having a Disaster Preparedness Plan means a museum has implemented action to prevent disasters from occurring and has prepared by developing the necessary procedures to effectively respond to and recover from a disaster when it does occur, thereby reducing the impact on the staff, the collection and the museum.

It is a document containing information on the standard operating procedure to be adopted in an emergency caused by any disaster. By its comprehensive nature, it saves the time used in thinking in emergencies. With training drills it ensures a quick response from the people involved. It does not respond to emergencies ? it is people who do that. It ensures that staff are familiar with the plan

and their roles in it, and that they have the resources, training, and authority to undertake their duties and responsibilities. This information has to be made up-to-date and the plan practiced regularly. Emergency preparedness does not stop once a written disaster management plan is completed.

5. Disaster Response Team

A disaster response team should be organized in the institution. It should have the co-ordinator, conservator, civil engineer, electrical engineer, fire officer, revenue officer, police officer, health officer and others. They should be given specified duties and meet regularly to review the situation in the institution.

6. Duties of the Disaster Response Team

The duties of the Disaster Response Team are multifarious:

- declaring emergencies and implementing the emergency plan;
- implementing evacuation procedures;
- contacting emergency services (fire, police, ambulance) and utilities;
- establishing a command post, chain-of-command and reporting

procedures;

- accessing and stabilising the environment;
- assessing emergency services, supplies and equipment;
- obtaining emergency services, supplies and equipment;
- ensuring the safety of staff and volunteers at all times during an

emergency;

- arranging for off-site storage and work facilities;
- arranging the transfer of collections to a safe site;
- recording the movement of collections;
- contacting, deploying and supervising museum staff;
- implementing and supervising salvage procedures for collections;
- contacting, training and supervising volunteers;
- documenting all aspects of the response / recovery procedures;
- signing purchase orders;
- meeting with the press;
- preparing post-emergency reports.

7. Emergency Plan

I. Authority Statement

When there is a disaster, the head of the mansion authorises staff, employees to deal with the emergency. The head of the institution's disaster response team is vested with the authority to declare a state of emergency and to make appropriate use of whatever resources are necessary.

II. Policy Statement

During a disaster, the museum declares its priorities to be:

1. protection of life;
2. protection, recovery and stabilisation of the collection of records.

To achieve this, it authorises the bypassing of normal procedures.

III. General Instructions

1.Wherever necessary, visible emergency exit signs must be posted clearly;
2.on hearing an alarm or information from staff, all persons shall evacuate the museum buildings;
3.copies of the emergency plan should be readily available to the disaster response team;
4.the disaster response team has authority in all practical matters for the duration of the emergency.

8. Appendices

There should be details of information as required below to take swift action during any disaster:

1. complete staff list with addresses and phone numbers;
2. emergency response team call-out list with phone numbers (check weekly);
3. public emergency service phone numbers (check annually);
4. phone and fax numbers, e-mail IDs of other sources of emergency support and appropriate Public Works authorities (check annually);
5. phone and fax numbers, e-mail IDs and addresses of local suppliers of equipment, materials, freezing services, ambulance, accommodation and services that might be required (check annually);
6. building information, with plans showing location of water, electricity, gas and compressed air circuits and all switches and cut-off points (update annually);
7. lists of emergency equipment and materials held in stock with quantities and location (check stock and update monthly);
8. lists and locations of fire-fighting equipment and first aid supplies (check monthly and update monthly);
9. location of safe copies of records of the collections and Disaster Plan;
10. distribution of "Disaster Plan" and "Appendices": I, II & III to all staff; III at points 1 and 2 in every room; Appendices 2 and 3 beside every telephone.

9. Checklist

A checklist is a must to assess the condition of the damage to the property. A conservator may be summoned to advise, if necessary. There are many conservation procedures to rescue affected manuscripts and art objects. Curators, archivists, librarians and the collection managers, keepers, caretakers and others concerned may contact suitable persons for the conservation of affected objects after the recovery of the objects has been completed (Fig. 6, 7).

Fig. 6 Exits - Assembly Spot for Evacuation

Fig. 7 Mitigation Measures

10. in case of fire

Emergency preparedness plan and response plan for fire station near vimanmek mansion (Fig. 8).
In case of fire and mansion 's staff can not put out fire.
If the staff can not put out fire then they will call to fire truck that stand by in mansion . firefighter will reach the scene very fast. Even the first fire truck can not put out fire then they will ask support team from the nearly fire station.

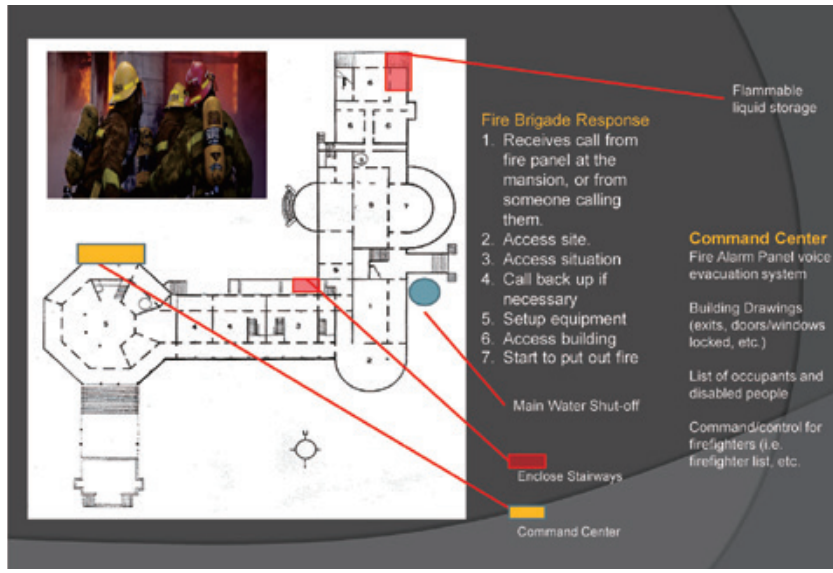

Fig. 8 Firefighter Building Information

11. Strategics goals and tactical objectives

Fire fighting has some basic skills: prevention, self-preservation, rescue preservation of property, basic first aid, and fire control. Firefighting is further broken down into skills which include size-up, extinguishing, ventilation, salvage and overhaul. Wildland firefighting includes size up, containment, extinguishment, and mop up. Search and Rescue, which has already been mentioned, is performed early in any fire scenario and many times is in unison with extinguishing and ventilation.
Following is the application of the strategic goals as presented in this column to this specific incident.

12. Firefighter safety

Self - preservations

Tools are generally carried at all times and are important for not only forcible entry but also for self-rescue. A self ? contained breathing apparatus (SCBA) delivers air to the firefighter through a full face mask and is worn to protect against smoke inhalation, toxic fumes, and super heated gases. A special device called a personal alert safety system (PASS) is commonly worn independently or as a part of the SCBA to alert others when a firefighter stops moving for a specified period of time or manually operates the device. The PASS device sounds an alarm that can assist another firefighter. Firefighters often carry personal self-rescue ropes. The ropes are generally 30 feet long and can provide a firefighter (that has enough time to deploy the rope) a partially controlled exit out of an elevated window.
Sometime fatalities of firefighters are caused by vehicle accidents while responding to or returning from an incident. Many firefighters are also injured or killed by vehicles while working at an incident. a new measure was established by many departments that requires firefighters to wear a bright orange reflective vest over their turnout coats while working on the scene of vehicle accidents. The advent of this measure was implemented so firefighters are more visible to the other drivers on the road.

13. Search and rescue

Unless the occupants of the entire building are accounted for , an interior search must be conducted. Unless there are other obvious needs , the search should progress as follows . The apartments on the fire floor should be searched first , starting with the fire apartments and working out into adjoining apartments. The floor above should be searched next or preferably simultaneously if staffing permits. On the top floor the search should start with the apartment above the fire and work outward .

14. Evacuation

Evacuation needed for everybody .while the products of the fire have not yet affected the building occupants, they should be evacuated. Then firefighter should make the easy way for evacuation.

15. Extinguishment

Theory of fire extinguish
A fire will continue to burn as long as there is FUEL, OXYGEN and HEAT available. Fire extinguishment is achieved by the removal of either the FUEL, OXYGEN or HEAT or by the interruption of the chemical chain reaction. This is achieved by:

STARVING
Removal of the unburnt material
This includes turning off the gas
SMOTHERING
Preventing the oxygen (air) from combining with the fuel
This is how a fire blanket works
Cooling
Reducing the temperature of the burning material to below its ignition point.
Adding water to a Class A (solid combustible) fire does this
Firefighter team should decide the best way to put out fire by depend on situation and equipment or etc.

16. Ventilation

Ventilation is an important part of structural firefighting tactics, and involves the expulsion of heat and smoke from a fire building, permitting the firefighters to more easily and safely find trapped individuals and attack the fire. If a large fire is not properly ventilated, not only will it be much harder to fight, but it could also build up enough poorly burned smoke to create a smoke explosion or enough heat to create aflashover. Contrarily, poorly placed or timed ventilation may increase the fire's air supply, causing it to grow and spread rapidly. The flashover may cause the temperature inside the building to peak at over 1000 °C (1850 °F).

Mechanical fans can be used to provide positive ventilation when used in tandem with either existing openings such as windows , skylight or heat/smoke vents on the roof. However firefighter team can send rescue team by using guide line for go in the smoke room and open the window for good ventilation.

17. Recovery planning - fire

Immediate Term

Stabilize the situation.

Assess structure and determine condition, safe for access, etc.

Short Term

begin to recovery working with restoration/conservation expert.

Long-term recovery plan

- Incorporate 'lessons learned'
- Give knowledge to fire fighter and communities about cultural heritage.
- Complete and thorough assessment of the community's permanent recovery needs.
- Continued training of:
  - The mansion 's staff
  - the fire dept regarding pre-planning and regular inspections

18. Knowledge about cultural heritage

The important is knowledge of Firefighter in cultural heritage . Firefighter should have knowledge about vimanmek mansion . they have to know that how important of antiques in palace and also know the area around vimanmek mansion because when in case of fire they can set up ladder truck, water truck for working. Sometimes we can not set up fire engine in the narrow street . excellent firefighters are very good for work in worst case because in case of fire Eventhough they can not put out fire atleast they can decide to bring important antiques from fire.

19. Flooding (Fig. 9)

preparing

- Preparing water pump
- Store valuables at upper levels
- checking drainage system around mansion., preparing equipment for flooding.

recovery

- Assess damage to structure
- Assess damage to building
- Stabilize the situation
- Continue pumping out water
- Call conservator/restoration expert to assess impact on heritage aspects.
- Implement plan to save/conserve/restore heritage.
- Work with local community in recovering the mansion and the local community areas.

Fig. 9

References

1) Commissioner of museums government of Tamil Nadu india, R.
2) James Angel: Firefighting strategies and tactics
3) Wikipedia

Appendix

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(As of 2014 September)

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Photos of ITC 2014

Opening address given by the Vice Chancellor, Ritsumeikan University

Congratulatory address given by the Toyota Foundation

The first Group Photo by the trainees and Lecturers of ITC2014

Site investigation of wooden heritage buildings at *Kiyomizu-Dera* Temple

Field work for Risk Assessment at *Sannei-Zaka* Important Preservation District and there surroundings

Workshop for Impact of Disaster on Cultural Heritage

Observing Disaster Prevention Facilities for Cultural Assets at *Ninna-ji* Temple

Site Visit at Kobe to learn the recovery from the Hanshin-Awaji Earthquake, 1995

Workshop at the *Minami-Sanriku- Cho* disaster affected area by the Great East Japan Earthquake and Tsunami

Resource Person from UNESCO WHS, Dr. Giovanni BOCCARDI

Resource Person from ICCROM, Dr. Joseph Allan KING

Case Study Project of “Cultural Heritage Disaster Prevention Plans” prepared by the participants

Presentation of completion certificates to the participants

The last group photo of ITC2014 with the Experts of International Organizations

Former Town Center of Minami-Sanriku-Cho Tsunami affected area.
3 years passed from East Japan Earthquake, new roads are constructing on the old land.

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