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International Conference on Building Resilience 2011: Book of Abstract

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Building Resilience brings together contributions from the 2011 Conference of the International Institute for Infrastructure Renewal and Reconstruction, held at Kandalama, Sri Lanka, 19th – 21st July 2011. It includes 109 abstracts by scholars and practitioners around the world. The full papers are available on an accompanying USB drive.

With growing population and infrastructures, the world's exposure to hazards – of natural and man-made origin – is inevitably increasing. This reality reinforces the need to proactively consider disaster risk as a part of the sustainable development agenda. The International Conference on Building Resilience will encourage debate on individual, institutional and societal coping strategies to address the challenges associated with disaster risk. Central to these strategies is the concept of resilience, which is becoming a core concept in the social and physical sciences, and also in matters of public policy. Resilience refers to the capability and capacity of systems to withstand change. By encouraging participation from researchers in the social and physical sciences, the conference will explore inter-disciplinary strategies that develop the capacity of a system, community or society potentially exposed to disaster related hazards, to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure.

The conference outcomes will be used to support the 2010-2011 World Disaster Reduction Campaign 'Making Cities Resilient', which addresses issues of local governance and urban risk while drawing upon previous ISDR Campaigns on safer schools and hospitals, as well as on the sustainable urbanizations principles developed in the UN-Habitat World Urban Campaign 2009-2013. Mayors and their local governments are both the key targets and drivers of the campaign. The overall target of the Campaign is to get as many local governments ready as possible, to span a global network of fully engaged cities of different sizes, characteristics, risk profiles and locations. The campaign is focusing on raising political commitment to disaster risk reduction and climate change adaptation among local governments and mayors; including through high profile media and public awareness activities, and will develop specific technical tools that cater for capacity development opportunities.



International Conference on Building Resilience

Interdisciplinary approaches to disaster risk reduction and the development of sustainable communities

Kandalama, Sri Lanka 19th - 21st July 2011



Book of Abstracts



Edited by

Professor Dilanthi Amaratunga
Dr Richard Haigh
Dr Kaushal Keraminiyage
Dr Udayangani Kulatunga
Dr Chaminda Pathirage

Annual Conference of the
International Institute for Infrastructure
Renewal and Reconstruction

University of Salford
A Greater Manchester University

International Conference on Building Resilience



In support of the United Nations International Strategy for Disaster Reduction (UNISDR)
World Disaster Reduction Campaign 2010-2011 "Making Cities Resilient"

BUILDING RESILIENCE 2011

*Interdisciplinary approaches to disaster risk reduction, and the
development of sustainable communities and cities*

Book of Abstracts

Edited by

Professor Dilanthi Amaratunga, Dr Richard Haigh,
Dr Kaushal Keraminiyage, Dr Udayangani Kulatunga & Dr Chaminda Pathirage

July 2011

Professor Dilanthi Amaratunga, Dr Richard Haigh,
Dr Kaushal Keraminiyage, Dr Udayangani Kulatunga & Dr Chaminda Pathirage (*edited by*)
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Book of Abstracts

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Contents

Foreword	iii
Preface	v
About the Editors	vii
Acknowledgements	ix
Conference Organisation	xi
<i>Organising Committee</i>	<i>xi</i>
<i>Local Organisers and Hosts</i>	<i>xi</i>
<i>International Scientific Committee</i>	<i>xii</i>
<i>International Institute for Infrastructure Renewal and Reconstruction</i>	<i>xiv</i>
<i>Centre for Disaster Resilience, University of Salford, UK</i>	<i>xv</i>
Sponsors	xvii
Keynote Speakers	xxi
Special Features, Events and Workshops	xvii
<i>UNISDR 'Making Cities Resilient' Campaign</i>	<i>xxvii</i>
<i>UN Global Assessment Report 2011</i>	<i>xxx</i>
<i>ARCOM & Northumbria University Doctoral Research Workshop</i>	<i>xxxii</i>
<i>BELLCURVE: Built Environment Lifelong Learning Challenging University Responses to Vocational Education</i>	<i>xxxiii</i>
<i>CEREBELLA: Community Engagement for Risk Erosion in Bangladesh to Enhance Lifelong Learning</i>	<i>xxxiv</i>
<i>Reconstruction for Peace</i>	<i>xxxv</i>
Awards	xxxvii
Special Issue of the International Journal of Disaster Resilience in the Built Environment	xxxvii
General Information	xxxix
Abstracts	1
Introduction	3
Index of Authors	115

Foreword

Our world is increasingly subject to hazards that challenge conventional wisdom, both in anticipating natural and human-made disasters, and in responding to them. This conference has brought together expertise, across a wide range of disciplines and fields of study, around the central theme of resilience. By looking at the capability of systems to withstand change, this approach will inform both practice and the development of appropriate public policy. By spanning the social and the physical sciences, this set of contributions points to the key transdisciplinary themes that will inform the future of this area of work. This is both timely and urgent; getting resilience to disasters right has the potential of preventing loss of life on a massive scale, and of mitigating the suffering that has been all too evident in the string of recent disasters across the world.

The collaboration between the Centre for Disaster Resilience, School of the Built Environment, University of Salford, RMIT University, Australia, the UNDP Sri Lanka and the Disaster Management Center, Ministry of Disaster Management, Sri Lanka has been highly productive. These international groups have come together with local organisers: the University of Moratuwa, the University of Peradeniya, the University of Colombo and the Chamber of the Construction Industry, Sri Lanka. This powerful alliance of organizations demonstrates a commitment to a step change in the ways in which researchers and professional practitioners approach this complex area.

By supporting the 2010-2015 World Disaster Reduction campaign, 'Making Cities Resilient', the proceedings of this conference will make a direct contribution to the development of informed public policy. The aim is to raise political commitment to disaster risk reduction and climate change adaptation among local governments and mayors.

The work on advancing disaster resilience that is expressed through the record of this conference comes at a time when leading scientists across the world are arguing that our planet has entered a new era – the Anthropocene – in which humans have supplanted natural forces as the primary determinant of the Earth's future. There can be no doubt that resilience to catastrophic disruptions will come to be one of the major themes in research and practice in this Anthropocene era.



Professor Martin Hall
Vice Chancellor, University of Salford

Preface

This book contains the abstracts of keynotes and papers submitted to, double blind peer reviewed, and accepted for the International Conference on Building Resilience 2011, 19th – 21st July at Heritance Kandalama, Sri Lanka.

The Conference is organised by the Centre for Disaster Resilience, School of the Built Environment, University of Salford, UK and RMIT University, Australia, in association with UNDP Sri Lanka, the Disaster Management Center, the Ministry of Disaster Management, the Central Environmental Authority Sri Lanka, the Ministry of Environment, IOC UNESCO, and the Royal Institution of Chartered Surveyors. The local organisers and hosts are the University of Moratuwa, the University of Peradeniya, the University of Colombo and the Chamber of the Construction Industry Sri Lanka.

This is also the Annual Conference of the International Institute for Infrastructure Renewal and Reconstruction (IIIRR), which is a multi-university international consortium that provides overall leadership in research, education, planning, design and implementation for mitigation of the impact of natural disasters, and infrastructure renewal and reconstruction projects in tsunami affected or underdeveloped regions.

With growing population and infrastructures, the world's exposure to hazards – of natural and man-made origin – is inevitably increasing. This reality reinforces the need to proactively consider disaster risk as a part of the sustainable development agenda. The International Conference on Building Resilience encourages debate on individual, institutional and societal coping strategies to address the challenges associated with disaster risk. Central to these strategies is the concept of resilience, which is becoming a core concept in the social and physical sciences, and also in matters of public policy. Resilience refers to the capability and capacity of systems to withstand change. By encouraging participation from researchers in the social and physical sciences, the conference explores inter-disciplinary strategies that develop the capacity of a system, community or society potentially exposed to disaster related hazards, to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure.

Contributions to the Conference are made by members of the research community and practice that address disaster risk and the need to develop resilience from diverse perspectives, as demonstrated by the range of subjects tackled by authors. The abstracts are a brief summary of the full research articles that can be found in the USB Drive that accompany this book. All abstracts and full papers were reviewed in their entirety, prior to publication, by the International Scientific Committee comprising independent, qualified experts. Editors would like to extend their sincere gratitude to all the authors of the published contributions for their excellent work and participation at the International Conference on Building Resilience 2011.

The Conference organisers are delighted to welcome the Chief Guest, the Honourable Professor G. L. Peiris, Minister of External Affairs. The Organisers also welcome five keynote addresses by leading industrialists and academics: Dakshitha Thalgodapitiya, CEO Chamber of Construction Industry Sri Lanka; Dr Ananda Mallawatantri, Environment, Energy and Disaster Risk Management, United Nations Development Programme, Sri Lanka; Professor Peter Barrett, Professor of Management in Property and Construction at University of Salford, UK; Professor John Fein, Professor of Sustainability in the Innovation Leadership programme of RMIT University, Australia; and, Professor Terrence Fernando, Director of the Future Workspaces Research Centre, University of Salford, UK. These keynote addresses provide a local and global perspective and vision for disaster resilience research.

The conference outcomes will be used to support the 2010-2011 World Disaster Reduction Campaign 'Making Cities Resilient', which addresses issues of local governance and urban risk while drawing upon previous ISDR Campaigns on safer schools and hospitals, as well as on the sustainable urbanizations principles developed in the UN-Habitat World Urban Campaign 2009-2013. Mayors and their local governments are both the key targets and drivers of the campaign. The overall target of the Campaign is to get as many local governments ready as possible, to span a

International Conference on Building Resilience 2011

global network of fully engaged cities of different sizes, characteristics, risk profiles and locations. The campaign is focusing on raising political commitment to disaster risk reduction and climate change adaptation among local governments and mayors; including through high profile media and public awareness activities, and will develop specific technical tools that cater for capacity development opportunities.

The conference is being held in Sri Lanka, an island situated in the Indian Ocean, at the base of the Indian Sub-Continent. It is a multi-ethnic, multi-religious country with a diverse and rich culture. Sri Lanka was severely affected by the tsunami on 26 December 2004, which killed some 40,000 people and displaced 400 – 500 thousand people along two thirds of the north-east, south and south-west coastline. Half the fishing fleet was destroyed, and a quarter of hotels in the affected areas sustained serious damage. Conflict has also featured significantly in Sri Lanka's recent history and social development, most notably in the North and East of the country. While the war came to an end with the military defeat of the LTTE in May 2009, over 100,000 are estimated to have been killed and over a million displaced. Income levels and human development indicators for these areas are among the lowest in Sri Lanka. It is our hope that Sri Lanka will benefit greatly from the research and activities associated with the Conference, and that the country provides an appropriate backdrop for tackling challenging questions about how to develop disaster resilient communities.



Professor Dilanthi Amaratunga
Conference Chair



Dr Richard Haigh
Conference Chair

About the Editors

Dilanthi Amaratunga is Professor of Disaster Management at the School of the Built Environment, University of Salford, UK where she leads the University's Centre for Disaster Resilience, responsible for supporting research on disaster management portfolios. She is also the Associate Head of International Development for School of the Built Environment. Her research interests include post disaster reconstruction including conflict mitigation, gender and projection; capability and capacity building in managing disasters; socio-economic measures for conflict-affected reconstruction; and, women in construction. An interdisciplinary background in Quantity Surveying, Facilities and Business Continuity Management, Education and Training, Gender and Disasters, and Disaster Mitigation and Reconstruction provides her the opportunities to work across a broader disaster management research agenda including developing partnerships with international research teams, government, NGOs and communities. She is the Co-Editor of the International Journal of Disaster Resilience in the Built Environment, the only journal to promote research and scholarly activity that examines the role of building and construction to anticipate and respond to unexpected events that damage or destroy the built environment.

Dr Richard Haigh (r.p.haigh@salford.ac.uk) is a Senior Lecturer at the Centre for Disaster Resilience, School of the Built Environment, University of Salford, UK. He is also Co-Editor of the International Journal of Disaster Resilience in the Built Environment. His research focuses on the application of disaster risk reduction in the built environment, including the conceptual understanding of resilience, the reintegration and rehabilitation of conflict affected communities, and corporate social responsibility in disaster risk reduction. Richard is Principal Investigator of a UK Foreign and Commonwealth funded research project entitled Reconstruction for Peace, which is exploring the factors of infrastructure reconstruction programmes that impact social cohesion within conflict affected communities in Sri Lanka. Richard was Co-Chair of the 2008 Building Education and Research Conference, held in Kandalama, Sri Lanka. The conference focused on the built environment field's role in developing society's resilience to disasters. Further information on Richard's experience and publications can be found at www.richardhaigh.info.

Dr Kaushal Keraminiyage (k.p.keraminiyage@salford.ac.uk) is a Lecturer at the University of Salford, UK teaching on both undergraduate and postgraduate courses. He is also the programme director for the BSc (Quantity Surveying) programme. His research interests are collaborative environments for construction education and research, building capacities of construction Higher Education Institutions through ICT enabled collaborations, ICT for the Built Environment in disaster management contexts, energy conscious construction through process / ICT co-maturation and Virtual Learning and Research Environments for the Built Environment. Kaushal's publication profile includes edited books, book chapters, journals papers, various reports and international conference papers and presentations. He is a member of the Editorial Board of the International Journal of Disaster Resilience in the Built Environment and he has facilitated a number of international research workshops and served as an organising committee member in a number of international conferences.

Dr Udayangani Kulatunga (U.Kulatunga@salford.ac.uk) is a Lecturer at the School of the Built Environment, University of Salford, UK. She has over 7 years of experience in teaching and research in the UK and Sri Lanka. Udayangani is also the programme director for the BSc (Hons) Quantity Surveying - Sri Lanka programme. She leads the research themes "disaster risk reduction" and "culture and disaster risk reduction" at the Centre for Disaster Resilience, at the University of Salford. In year 2010, she won the INSPIRE exploratory grant funded by the British Council to explore disaster risk reduction activities in Bangladesh. Currently she is working on a INSPIRE strategic partnership with Bangladesh on developing community based disaster risk reduction strategies. Udayangani has worked as a Guest Editor for a number of special issues including a special issue in International Journal of Strategic Property Management on disaster management. Her research output is demonstrated by the number of publications done in journals, book chapters and international conferences.

Dr Chaminda Pathirage (c.p.pathirage@salford.ac.uk) is a Lecturer at the School of the Built Environment, University of Salford, UK. He is also the Programme Director for MSc Project Management in Construction degree programme since 2009. Having worked in several RICS (Royal Institution of Chartered Surveyors) funded research projects on good practices in disaster context, Chaminda has developed his specific research interest on exploring the role of knowledge management in the disaster management cycle. He leads the research theme 'Knowledge Management for Disaster Resilience' at the Centre for Disaster Resilience, at University of Salford. Currently Chaminda is managing a strategic partnership between RICS Disaster Management Commission and Centre for Disaster Resilience on teaching and research collaborations. He is also an Editorial Advisory Board member of the International Journal of Disaster Resilience in the Built Environment and an Editorial Review Board Member of International Journal of Knowledge-Based Organizations. With over 9 years of research and teaching experience, Chaminda has published several book chapters, research reports, journal papers and international conference papers and has facilitated a number of research workshops in International conferences.

Acknowledgements

As Chairs of the International Conference on Building Resilience 2011, *Interdisciplinary approaches to disaster risk reduction, and the development of sustainable communities and cities*, we are delighted to have the opportunity to hold this conference.

The Local Organising Committee met regularly and together we made an array of, hopefully better, key decisions! All involved have provided a willing source of on-going support and guidance that is very much appreciated. Our thanks go to the International Scientific Committee members who made extensive efforts in reviewing papers to tight time scales in ensuring the high quality of the conference. We also thank the key note speakers for their willingness to stimulate invaluable discussions and debate around the conference theme. We also thank session chairs for agreeing to ensure the conference is as challenging, exciting and rewarding as possible.

We have received exceptional help and support from a number of people, organisations and bodies in the work for this conference. We would particularly like to acknowledge the support of Professor Martin Hall, Vice Chancellor of the University of Salford, and Professor Mike Kagioglou, Head of the School of the Built Environment at the University of Salford. In addition to funding by means of a sponsorship, the School of the Built Environment provided unwavering backing and encouragement.

Organisations that have provided sponsorships are especially thanked. The costs involved with a conference of this scale are significant and it would not have been possible to organise this conference without assistance. We particularly thank the University of Salford and its School of the Built Environment, the Ministry of Environment, Sri Lanka, the International Journal of Disaster Resilience in the Built Environment and Emerald Publishing. Professor Charles Egbu deserves special thanks for facilitating sponsorships for the Centre for Disaster Resilience and also for several postgraduate research students.

The International Conference on Building Resilience 2011 is being held in conjunction with BELLCURVE (Built Environment Lifelong Learning Challenging University Responses to Vocational Education). BELLCURVE is an EU funded research project which aims to modernise higher education institutions through governance reforms. The University of Salford in United Kingdom leads this project in partnership with Tallinn University of Technology in Estonia and Vilnius Gediminas Technical University in Lithuania. Accordingly, we acknowledge the financial support of the European Commission and the Lifelong Learning Programme of the European Union in facilitating the dissemination and exploitation of the research outcomes through various means including keynotes, presentations, publications, marketing and workshops in conjunction with the conference activities.

Most of all, we want to thank our colleagues who worked very hard for the professional undertaking of the work involved in the tasks that are so often unseen and unrewarded for a conference of this scale. We thank Dr Kaushal Keraminiyage for all his efforts on the development and management of the conference database, Dr Chaminda Pathirage for being so careful with finances during these difficult times and also for managing the registration process, Dr Udayangani Kulatunga for her help in the management of the paper review process, and Menaha Thayaparan, Chamindi Malalgoda and Mohan Siriwardena for being there whenever we needed help. We also thank Andrew Crozier, Vanda Tomlinson and Karen Blake for their excellent support with university finances.

Finally, we would not have been able to make this event without the support of our Events Manager based in Sri Lanka, Aitken Spence Conventions and Exhibitions. Ziyen Ameen & Nadeeka Leeniyagoda deserve special thanks from us for the professional way in which they have managed the complex accommodation arrangements for delegates, all internal transport, printing assignments, and coordination of our suppliers in Sri Lanka.

Professor Dilanthi Amaratunga
Conference Chair

Dr Richard Haigh
Conference Chair

Conference Organisation

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International Institute for Infrastructure Reconstruction and Renewal



Disasters, whether small or large, have significant adverse effects on communities and ecosystems. What makes a disaster a large-scale one is the number of people and infrastructure affected by it and/or the extent of the geographical area involved. Such disasters hugely impact the resources of local communities and central governments. Return to normalcy is typically a slow process that depends on the severity of the disaster.

An “unusual” and “disastrous” world event occurred when the massive December 26, 2004 tsunami struck several Indian Ocean countries. That caused several researchers from four countries, and eight universities, led by Canadians to form a group called “International Institute for Infrastructure, Renewal and Reconstruction (IIIRR)” to research natural disasters and how their impact could be mitigated (www.iiirr.ucalgary.ca). Currently, IIIRR is comprised of 15 Universities from USA, Canada, Germany, UK, Australia and Sri Lanka. Following six successful years of activities related to disaster mitigation of several major disasters, we believe it is time to take disaster mitigation activities throughout the entire world to the next level. Given the situation with global warming, and the “emerging” risk posed worldwide, our interest in taking a “multidisciplinary” approach to the related problems is timely.

The core of IIIRR consists of a group of interdisciplinary experts who serve as the facilitators for social development, industrial and economic growth as well as environmental preservation through infrastructure development. Innovative and socially responsible projects inspired via internal synergies of the IIIRR will lead to rapid development and improved quality of life. By providing stewardship in infrastructural rebuilding efforts, the IIIRR also creates a common platform for discussion and collaboration among diverse entities such as government, the corporate sector, NGOs and universities, each having specific but diverse goals and priorities. The IIIRR provides leadership to leaders and facilitates discussion and planning activities among relevant bodies, while operating on an outcomes-based strategy for rapid sustainable infrastructure development.



Professor Janaka Y. Ruwanpura
Convener, IIIRR
Canada Research Chair in Project Management Systems
Director and Professor, Centre for Project Management Excellence
Schulich School of Engineering, University of Calgary, Canada

Centre for Disaster Resilience, University of Salford, UK

The University of Salford's built environment research was ranked 6*, the highest grade in the UK's competitive RAE in 2001 and 1996, the only built environment research institute in the UK to achieve this. In the 2008 RAE its research in the fields of architecture and the built environment was rated as the best in the UK and finished top in Research Fortnight's 'Research Power' table for built environment. Its built environment research institute has over 110 research-active academic staff, and considerable experience of large research projects – between 1996 and 2009, it completed over £60M of funded research including major EU research projects and networks. Salford has one of three UK government funded research centres in the built environment and attracted contributions from more than 400 industrial partners worldwide. Salford hold several key positions of the CIB (International Council for Research and Innovation in Building & Construction), a worldwide network of over 5000 experts from about 500 member organisations active in the research community, in industry or in education, who cooperate and exchange information in over 50 CIB Commissions.

The University's Centre for Disaster Resilience (www.disaster-resilience.salford.ac.uk) is an integral part of Salford's built environment research and it promotes research and scholarly activity that examines the role of the built environment industry to anticipate and respond to disasters that damage or destroy communities and their built, natural and human environment. The Centre promotes a multidisciplinary approach to the management of disasters and undertakes cooperative research with a large number of international partners. It is also an academic partner of the UNISDR Resilient Cities campaign, aimed at raising awareness of the need for disaster risk reduction among local governments around the world. Members undertake research in the areas of: Resilience in the built environment; Disaster risk reduction; Social impact of reconstruction; Community engagement and participation in reconstruction; Conflict sensitive reconstruction; Protection and empowerment of women and other vulnerable groups; Livelihood development and community co-operatives. It is very experienced in organising networking events in the field, including the International Building Education and Research conference that focused on the role of the built environment in managing disaster risk (www.bear2008.org).

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The University is implementing a new far-reaching strategy to transform Salford into a vibrant, research-led University by 2017. This strategy will shape the future of our research and innovation by unlocking the talent and potential of our staff and students, working closely with our collaborators in business, government and the community.

We are committed to undertaking research that yields new knowledge that is of global significance, but which also delivers direct benefits to local communities. We are a University that is in Salford and for Salford.

The success of our real-world focus and interdisciplinary ethos was confirmed in the 2008 Research Assessment Exercise (RAE), which placed Salford in the top third of UK universities for research (in terms of Research Power). 83% of work submitted was rated as 'internationally recognised' (2* and above) and 43% of work was rated as 'world-leading' (4*) or 'internationally excellent' (3*). The Architecture & Built Environment return came top of the Research Fortnight power rankings and had the most world-leading (4*) research. This return also had the most research of international significance (2* and above). Library & Information Management ranked 2nd in the Research Fortnight power rankings

RAE 2008 demonstrated that the University has developed its research profile significantly since RAE 2001 and we now have 50% more academics (the great majority) involved in research. We have created a world-class research infrastructure through state of the art facilities such as the Think Lab. A dedicated Research & Graduate College provides support for research through a variety of internal schemes offering support for a range of activities, including bidding, early career research and conference travel.

Our website (www.salford.ac.uk) offers a gateway to our online research resources, which include The University of Salford Institutional Repository (USIR) and SEEK (the Salford Environment of Expertise and Knowledge), a searchable online expertise database which showcases the research achievements and interests of our staff members through a series of web profiles.

School of the Built
Environment, The University
of Salford, UK



The School of the Built Environment (www.sobe.salford.ac.uk) has an exciting and vibrant research community engaged in advanced research in the Built Environment, much of which also involves national and international partners. We enjoy a top position in the UK government national research assessment which recognises the outstanding national and international profile of our academic staff. We are also number one for research power, a position held since 1992 (source: Research Fortnightly Magazine 2008).

SOBE makes a major contribution toward realization of the University strategic research theme of Built and Human Environment. This aims to transform the quality of life for society whilst ensuring the well-being of future generations through the provision of better and more sustainable futures. Key priority areas of this theme overall are sustainability and sustainable communities, which include issues such as energy production and consumption, healthy, accessible, inclusive and learning environments and wellbeing, disaster mitigation and reconstruction. Our aim is to act as the catalyst for positive change, both within the Built and Human Environment and at its many interfaces with the natural environment, engineering, health and social sciences. In doing so the theme will pay a leading role in shaping the Built and Human Environment towards green and sustainable futures incorporating high quality living and social responsibility.

United Nations Development
Programme Sri Lanka



The United Nations Development Programme (UNDP) is the UN's global development network, advocating for change and connecting countries to knowledge, experience and resources to help people build a better life. It is present in 166 countries working with them on their own solutions to global and national development challenges. As they develop local capacity, they draw on the people of UNDP and its wide range of partners.

UNDP began operations in Sri Lanka in 1967. UNDP's overarching goal is to support the country in the attainment of the Millennium Development Goals and the reduction of poverty. UNDP pursues this goal by working closely with the Government of Sri Lanka and supporting its agenda and objectives as captured within the framework of the United Nations Development Assistance Framework (UNDAF) and in line with the government's national development strategy, set out in the 'Mahinda Chinthana: Vision for a New Sri Lanka'.

Disaster Management Center,
Ministry of Disaster
Management



In July 2005, the Sri Lanka Disaster Management Act No.13 of 2005 was enacted which provides the legal basis for instituting a disaster risk management system in the country. The National Council for Disaster Management (NCDM) is a high-level inter-ministerial body. The chairman and vice chairman of the NCDM are H.E. the President and Hon Prime Minister respectively. Other members are Leader of the Opposition, Ministers in charge of 20 selected subject areas, Provincial Council Chief Ministers and five members of the Opposition. The Act also provides for establishing the Disaster Management Centre (DMC) under the Council to be the apex body for the purpose of planning, co-coordinating and implementing of certain natural and other forms of disasters.

Central Environmental
Authority



The Central Environmental Authority (CEA) was established in August 1981 under the provision of the National Environmental Act No: 47 of 1980. The Ministry of Environment and Natural Resources (ME&NR) which was established in December 2001 has the overall responsibility in the affairs of the CEA with the objective of integrating environmental considerations in the development process of the country.

Ministry of Environment



The Ministry of Environment of Sri Lanka remains committed for the management of the environment and natural resources of the country, maintaining the equilibrium between the trends in rapid economic development and use of natural resource base.

Social and economic behaviour of the increasing human population has put a major threat in achieving these objectives. The ministry has framed key policies for adoption in management of environment and natural resources of the country. These policies are implemented with the participation of stakeholders including government, agencies, NGO's and communities. In this context every citizen of Sri Lanka becomes a stakeholder. Through a large network of implementing agencies that come under the purview of the Ministry of Environment there policies are implemented. In addition donors have come forward to support the Ministry in implementing its activities and programs.

BELLCURVE



BELLCURVE
Built Environment Lifelong Learning Challenging University Responses to Vocational Education

BELLCURVE is a European Commission funded research project currently being conducted at the School of the Built Environment, University of Salford, UK, in partnership with the Department of Construction Economics and Property Management, Vilnius Gediminas Technical University, Lithuania and the Department of Building Production, Tallinn University of Technology, Estonia. BELLCURVE aims to address the mismatches between graduate skills and the construction labour market skill requirements. The construction industry, due to its labour-intensive, multi-disciplinary and highly fragmented nature, relies heavily on the skills and competencies of its workforce. The skills requirements in construction industry are of a dynamic nature, demanding professionals to continuously improve their skills and competencies. Higher Education Institutions (HEIs) are required to consider such emerging educational needs.

International Journal of Disaster Resilience in the Built Environment



Launched in 2010, the International Journal of Disaster Resilience in the Built Environment is the only journal to promote research and scholarly activity that examines the role of building and construction to anticipate and respond to unexpected events that damage or destroys the built environment, and reflects construction's on-going responsibility toward built environment's users. The journal is designed for researchers and academics, policy makers and other professionals working with, or who anticipate having, disaster prevention, mitigation, response and reconstruction responsibilities, and who wish to improve their working knowledge of both theory and practice.

Royal Institution of Chartered Surveyors (RICS) UK, Disaster Management Commission



Royal Institution of Chartered Surveyors (RICS) was founded in London in 1868, and granted a Royal Charter by Queen Victoria in 1881. It provides the world's leading professional qualification in land, property, construction and the associated environmental issues. Commitment to act in the interests of society remains RICS' guiding principle, and the RICS President's Disaster Management Commission was set up in 2005 to continue to deliver on that commitment. Commission aims to bring the skills and knowledge of RICS and other built environment professionals to strengthen capacity of vulnerable communities to reduce disaster risks and improve post-disaster recovery. BuildAction is an initiative of the Commission that places surveying and other built environment professionals on a pro bono basis with NGOs and humanitarian agencies to provide assistance to projects, in circumstances where it would otherwise not be available.

Keynote Speakers



Dakshitha Thalgodapitiya

CEO Chamber of Construction Industry Sri Lanka

Since 2002, Dakshitha Thalgodapitiya has been Chief Executive Officer & Secretary General of the Chamber of Construction Industry Sri Lanka, an apex body that represents architects, engineers and contractors, building material manufacturers, skilled workers, real estate developers, insurance companies, development banks, state agencies and others connected to the Construction Industry. Its aim is to influence government policies and instruct the government for the upliftment of the industry in specific, and the country in general. Mr Thalgodapitiya continues to be a vocal advocate for the need to deploy regional contractors on infrastructure development and construction related projects in the North and East of Sri Lanka. In support of this, the Chamber has been undertaking a Construction Craftsman Training Programme in Batticaloa with the assistance of the Government of Germany and in collaboration with GTZ

In 2005, Mr Thalgodapitiya was appointed as Director to the Colombo Stock Exchange by the Minister of Finance & Planning. Mr Thalgodapitiya is also a Member of the Board of Governors of the Sri Lanka National Arbitration Centre and a Technical Advisor to the International Labour Organization.

Challenges of post disaster reconstruction

Ensuring sustainability of interventions undertaken for post disaster reconstruction is a crucial challenge confronting countries like Sri Lanka. The process of Reconstruction can serve to reinforce and sometimes even increase the vulnerability of communities. Methodology, tools, techniques and delivery modes need to be addressed from a holistic and dynamic perspective and be an integrated process.

Corruption in the delivery of aid undermines the very spirit of humanitarian action. Aid can as a result of corruption be diverted away from the affected communities or distributed inequitably.

As the period of post disaster reconstruction can be particularly long, it is more prone to corruption due to a tendency to by-pass procurement procedures to ensure rapid rebuilding.

Good governance in reconstruction is more than preventing corruption. Accountability for the effectiveness of the reconstruction should be the overriding goal. Aide providers, governments and implementing agencies should jointly establish an environment for effective risk assessment to ensure proper financial management of reconstruction activities and capacity building of implementation. A holistic early warning system for corruption in reconstruction is necessary for achievement of the wider aim of social justice. Vulnerability to disasters and corruption in reconstruction should be viewed as production processes existing before as well as after disasters.



Professor Peter Barrett

Professor of Management in Property and Construction, University of Salford, UK

Professor Barrett is Professor of Management in Property and Construction at Salford University in the UK, where he is a past Director of Salford's top rated, 6* Research Institute for the Built and Human Environment (www.buhu.salford.ac.uk) and was Pro-Vice Chancellor for Research and Postgraduate Studies from 2001-08 with responsibility for all research across the University. He is currently Chairman of the £5M EPSRC funded, Salford Centre for Research and Innovation in the built environment (www.scri.salford.ac.uk). Peter is immediate past President of the UN-established International Council for Research and Innovation in Building and Construction (CIB - www.cibworld.nl) involving 2000 experts in 60 countries. His presidency culminated in the CIB World Congress in the UK in May 2010 on the theme of "Building a Better World" (www.cib2010.org). Around 650 delegates presented papers and addressed challenges from the UN, OECD, WHO and EC.

Peter has produced over one hundred and seventy single volume publications, refereed papers and reports, and has made over one hundred and ten presentations in around sixteen countries. Professor Barrett has undertaken a wide range of research. He is currently focusing on the theme of Revaluing Construction (www.cibworld.nl/revaluingconstruction) with a particular interest in the links between Senses, Brain and Spaces. This has led to practical work in the area of primary school design and achieving optimal learning spaces. In addition, and on a completely different tack, he runs a national UK network on Managing Academic Workloads (www.research.salford.ac.uk/maw). For more details of Peter's work see www.rgc.salford.ac.uk/peterbarrett/m/?s=10.

Building and sustaining institutional resilience

In advance of the conference Professor Barrett has been working with the organisers to carry out a Delphi questionnaire study amongst the participants. The results of this will be fed back at the conference covering issues such as the delegates' perceptions of trends in the incidence and impacts of disasters and the reasons behind these trends. In addition, views on the ISDR "Making Cities Resilient" campaign will be reported, including assessments of its scope and utility, and the state of play across its "Ten Essentials" for action. It is anticipated that this process will help those at the conference to develop a strong consensus on priority actions to address how to achieve practical resilience in the face of disasters. In so doing it is hoped that the many individual and valuable perspectives and efforts of the delegates will more strongly synergise.



Dr Ananda Mallawatantri

Team Leader, Environment, Energy and Disaster Risk Management, United Nations Development Programme, Sri Lanka

Ananda Mallawatantri counts over 30 years of professional experience in international development, project management, public sector, consulting, industrial production, environment and ecology related research and university teaching.

For the last five years he is attached to UNDP Sri Lanka as the Team Leader for Environment, Energy, and Disaster Management programmes. Prior to UNDP, Mr. Mallawatantri worked at the US Embassy and USAID Colombo as a project director and a senior advisor in environment and energy, for seven years. He conducted short-term consultancies for the International Water Management Institute and private sector. Mr. Mallawatantri worked in the Ministries of Public Administration and Plan Implementation as a member of Sri Lanka Administrative Service.

He holds a BS degree in Chemistry from the University of Colombo, MS Degree in Environment Science and Ph.D. in Soil Physics from Washington State University, USA. He also holds a Diploma in Business Administration from the University of Colombo. He was a Fulbright Student to USA between 1988 and 1992. His post-doctoral work at the University of Minnesota led to the development of Agro-Ecological Region based land use management practices for the State of Minnesota.

During the last decade his work in Sri Lanka contributed towards the improvements in air quality, water management, municipal waste processing, use of renewable energy, natural resources management and disaster risk management. He guides and teaches graduate students in his spare time.

Tools to facilitate disaster resilient construction

The presentation will focus on two key approaches undertaken in Sri Lanka to facilitate the disaster resilient construction, namely, the Integrated Strategic Environment Assessment for post-conflict Northern Province and National Hazard Profiles for coastal hazards, cyclones, droughts, floods and landslides. Key elements of the two approaches such as active participation of multiple stakeholders, generation of new information, data sharing, prioritization of land use through conflict resolution etc. will be highlighted. In addition a number of steps taken in Sri Lanka to develop building codes and designs to meet disaster risks and potential implications on the disaster potential due to climate change will be presented.



Professor John Fein

Professor of Sustainability in the Innovation Leadership programme of RMIT University, Australia

Professor John Fein holds the chair of Sustainability at RMIT University, the first such professorship in Australia. He is an experienced researcher and research leader with over AUD7m in national and international grants and over 100 academic publications since 1996. Current research projects include studies of “Effective Communication and Community Mobilization in Bushfire-Vulnerable Regions” and “Sustainable Housing Systems for Remote Indigenous Communities”. He has consulted widely for the World Bank, UNICEF, UNESCO, OECD and UNEP in most parts of SE Asia and Southern Africa. With a PhD in Geography and Education, he is a specialist in the use of multimedia in vocational and university education and is the developer of the award-winning multimedia program Teaching and Learning for a Sustainable Future (www.unesco.org/education/tlsf).

Breaching the urban contract: dividing walls in/to the resilient city

Cities and walls have a long, intertwined history. Physical barricades have historically provided a functional separation between civilized and uncivilized domains for resident communities. Walls ensured collective security: this was a fundamental part of the early urban contract. The city was a social fortress filled with allies in league against a common enemy: those outside the wall. In the past fifty years of increasing interethnic violence, the ‘enemy’ has been inside the city and the dividing walls, or some other forms of separation, have been built within the city. This represents an erosion of the urban contract and the ascendancy of fear, insecurity and vulnerability over resilience. This paper draws on research in five divided cities (Mostar, Beirut, Jerusalem, Belfast and Nicosia) to explore the descending spiral into conflict that results when the contract between vulnerable ethnic communities and city managers is broken. The paper concludes with an examination of urban design strategies through which resilience has been achieved.



Professor Terrence Fernando

Director of the Future Workspaces Research Centre, University of Salford, UK

Professor Terrence Fernando is the Director of the ThinkLab at the University of Salford, UK. The ThinkLab combines both physical and virtual spaces to provide innovative collaborative workspaces for innovation. Professor Fernando has a broad background in conducting multi-disciplinary research programmes involving a large number of research teams in areas such as distributed virtual engineering, virtual building construction, driving simulations, virtual prototyping, urban simulation, and maintenance simulation. As a part of the EU funded Future Workspaces roadmap project and the MOSAIC project, Prof. Fernando brought together over 100 companies and research centres from areas such as aerospace, automotive, building construction, multi-modal interfaces, system architecture, networking, human factors to define a 10 year European vision for future collaborative engineering workspaces and mobile workspaces. This work resulted in receiving 12MEuro from EU for a project called CoSpaces IP to implement an innovative collaborative technology platform for aerospace, automotive and construction industries, involving 22 European partners. He was also a core member of the INTUITION Network of Excellence project (5MEuro) involving over 50 research centres across Europe to develop coordinated research activities on VR. As a part of the EPSRC funded Vivacity project, he led the development of a collaborative urban planning environment in collaboration with the Black Country Consortium and Ordnance Survey. This work is now being further developed to support regeneration projects within Salford, involving a range of stakeholders including the City Council, Police, Primary Care Trusts and the Environment Agency.

Special Features, Events and Workshops

UNISDR 'Making Cities Resilient' campaign

The International Conference on Building Resilience 2011 is being held in association with the National Launch of the United Nations International Strategy for Disaster Reduction (ISDR) *Making Cities Resilient* Campaign.

The United Nations ISDR is working with its partners to raise awareness and commitment for sustainable development practices that will reduce disaster risk and increase the wellbeing and safety of citizens - to invest today for a better tomorrow. Building on previous campaigns focusing on education and the safety of schools and hospitals, ISDR partners launched a new campaign in 2010: Making Cities Resilient. The campaign is seeking to convince city leaders and local governments to commit to a checklist of Ten Essentials for Making Cities Resilient (enclosed herewith in Annex) and to work alongside local activists, grassroots networks and national authorities.

UNISDR and its partners have developed this checklist as a starting point for all those who want to join in the campaign. Equally important is that commitment to these Ten Essentials will empower local governments and other agencies to implement the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, adopted by 168 governments in 2005. Good urban and local governance is the key to this resilience!

The vision of the campaign is to achieve resilient, sustainable urban communities. The campaign will urge local governments to take action now to reduce cities' risks to disasters.

"My City is getting ready" is a rallying call for all mayors and local governments to make as many cities as possible as resilient as possible. It is also a call for local community groups, citizens, planners, academia and the private sector to join these efforts. While the campaign addresses citizens – those who live in urban areas and who elect the decision makers who can take the necessary steps to make their cities safer – the campaign's principal target groups are mayors and local governments of cities of different sizes, characteristics, locations and risk profiles. Mayors and local governments are the agencies who can take action and make our cities safer. Mobilizing these important actors in the disaster risk reduction process is essential to making cities resilient. The campaign slogan has meaning for everyone. Whatever the city, the message to reduce risk will resonate with all citizens worldwide. For example, Sao Paulo is Getting Ready! Kobe is Getting Ready! Istanbul is Getting Ready! Santa Tecla is getting ready!

Partners in the national launch of the campaign in Sri Lanka

The Ministry of Disaster Management and the Disaster Management Centre will lead the national launch in partnership with Ministry of Local Government, University of Salford UK, Practical Action, UNDP Sri Lanka and UNISDR. The International Conference on Building Resilience is being held in association with the Making Cities Resilient Campaign 2010-2015 national launch in Sri Lanka. The launch will provide an appropriate backdrop for policy, academic and practitioner audience to explore how they may support the campaign's goal: to help cities and local governments to get ready, reduce the risks and become resilient to disasters.

The launch of the Campaign aims to:

- To increase the knowledge and awareness of urban risk issues and solutions, as well as the role of local governments in addressing disaster risk at all levels (communication drive, adaptable to local needs and languages)
- To raise the political profile of disaster risk reduction for local governments and local governance, to improve the development investments to reduce risk and to provide

stronger synergy between local and national policies (promote “compacts” between local and national authorities).

- To develop a “Hyogo Framework for Local Governments” guide, enhance and disseminate technical tools to apply risk reduction at local levels (promote training, capacity development opportunities; city-to-city learning).

An overarching objective is to reach out to the public - citizens of cities and communities- to raise the general awareness levels and engagement for sustainable risk reduction and preparedness.

Target Audiences and Expected Outcomes

The campaign addresses primarily local governments at all levels (cities, towns, townships or villages) based on their responsibilities as first responders to the needs and well-being of the population. The campaign targets towards creating space for citizen participation, sound local/urban governance and accountability. More specifically, the Campaign will target:

- political leaders (Mayors, city councils)
- technical local govt functionaries and other experts with an impact on a city’s development and safety (planners, city managers in different sectors, building regulators, educators, emergency managers etc)
- local leaders, community and citizen groups, NGOs and other opinion makers- both as important partners, and targets.
- national authorities, in particular to promote decentralization and in their role of regulation and influence over local policy and risk configuration.
- other target audiences as appropriate per country or city, including with private sector.

It is expected that the Campaign and its launch in Sri Lanka will lead to:

- increased commitment from political leaders for making cities resilient;
- increased number of activities to disaster risk reduction in cities, both of national and local organizations that ultimately lead to making cities resilient;
- increased awareness in policy , planning and implementer stakeholders , and among citizens disaster risks, and possible measures for risk reduction
- sharing of good practices for making cities resilient and disaster risk reduction nationally, regionally and globally.
- enhanced practices for city-to-city learning

Campaign Update (Global)

At present, there are 629 cities and provinces in various countries joining the campaign. In many countries the campaign launch was also organised at Sub-national levels in addition to the national launches , for example in region 5 and 7 in the Philippines, Italy, in the state of Orissa in India, Province of Tyrol, Austria and all its 279 municipalities.

In the Global Platform for Disaster Risk Reduction which will take place during 8-13 May 2011 in Geneva, Switzerland will arrange the awarding ceremony for mayors or governors who won in Sasakawa Award, which was dedicated to the theme of Resilient Cities in 2011. The winners will be able to demonstrate how their achievements are linked to the current World Disaster Risk Reduction campaign, “Making Cities Resilient: My City is Getting Ready!” drawing on as many of the Ten Essentials as possible for addressing issues of local governance and urban risk.

Ten-point Checklist - Essentials for Making Cities Resilient

1. Put in place organization and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build local alliances. Ensure that all departments understand their role to disaster risk reduction and preparedness.
2. Assign a budget for disaster risk reduction and provide incentives for homeowners, low-income families, communities, businesses and public sector to invest in reducing the risks they face.
3. Maintain up-to-date data on hazards and vulnerabilities, prepare risk assessments and use these as the basis for urban development plans and decisions. Ensure that this information and the plans for your city's resilience are readily available to the public and fully discussed with them.
4. Invest in and maintain critical infrastructure that reduces risk, such as flood drainage, adjusted where needed to cope with climate change.
5. Assess the safety of all schools and health facilities and upgrade these as necessary.
6. Apply and enforce realistic, risk-compliant building regulations and land use planning principles. Identify safe land for low-income citizens and develop upgrading of informal settlements, wherever feasible.
7. Ensure education programmes and training on disaster risk reduction are in place in schools and local communities.
8. Protect ecosystems and natural buffers to mitigate floods, storm surges and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices.
9. Install early warning systems and emergency management capacities in your city and hold regular public preparedness drills.
10. After any disaster, ensure that the needs of the survivors are placed at the centre of reconstruction with support for them and their community organizations to design and help implement responses, including rebuilding homes and livelihoods.

The Campaign updates are posted on the campaign website and sent out to partners, participating cities and institutions. For further information please visit: www.unisdr.org/campaign.

UN Global Assessment Report 2011

The International Conference on Building Resilience 2011 incorporates the National Launch of the UN Global Assessment Report 2011.

The 2011 Global Assessment Report on Disaster Risk Reduction was prepared while disasters have continued to wipe out the lives and livelihoods of millions. The impacts of the catastrophic earthquake in Haiti in January 2010 and floods in Pakistan in July 2010 show how disaster risk and poverty are closely interlinked. Meanwhile, in 2011, floods in Australia, the earthquake in Christchurch, New Zealand, and the earthquake, tsunami and nuclear disaster wreaking havoc in north-eastern Japan as this report goes to press are a stark reminder that developed countries are also very exposed. Less visible internationally, hundreds of smaller disasters associated with climate variability have caused enormous damage in Benin, Brazil, Colombia, the Philippines and other countries. These events reveal how risks are continuously constructed through existing development gaps and growth in economic and population exposure. Moreover, as the Japan disaster highlighted, there are emerging risks and new vulnerabilities associated with the complexity and interdependency of the technological systems on which modern societies depend.

This second edition of the United Nations Global Assessment Report on Disaster Risk Reduction provides a current resource for understanding and analysing global disaster risk. Drawing on a large volume of new and enhanced data, it explores trends and patterns in disaster risk globally, regionally and nationally. In parallel, more than 130 governments are engaged in self-assessments of their progress in implementing the Hyogo Framework for Action (HFA), contributing to what is now the most complete global overview of national efforts to reduce disaster risk.

Findings show that accounting for disaster losses is a first step towards taking responsibility for, and assessing, disaster risk. Adapting existing development instruments such as national public investment planning, conditional cash transfers and temporary employment programmes, can help to scale up disaster risk management efforts to reach millions of risk-prone citizens. Such strategies reduce disaster risk and strive towards the objectives of the HFA, and are also important for adapting to climate change and achieving the Millennium Development Goals.

The production of this report was coordinated by the United Nations International Strategy for Disaster Reduction (UNISDR) secretariat, in collaboration with many global partners. Financial resources were contributed generously by, inter alia, the European Commission, and the Governments of Japan, Norway, Switzerland and the United States of America. Many other countries and organizations provided human and technical resources supporting research, workshops and studies necessary for the development of the report.

You can view the main report, chapter by chapter, within the USB drive Conference Proceedings that accompany this Book.

Alternatively, you can download from the following URL, both the main report, chapter by chapter, the Appendices, HFA Monitoring Country Reports and the set of contributing papers that constitute the substance which feeds the GAR:

<http://www.preventionweb.net/english/hyogo/gar/2011/en/home/download.html>

ARCOM & Northumbria University Doctoral Research Workshop: Building Resilience and Project Management

Professor Srinath Perera & Dr Chika Udejaja

The focus for this research workshop is on building resilience approaches in disaster management and sustainable construction applications and processes. Over the last ten years, there has been a great deal of interest in the study of building resilience and disaster management. Recent natural and human disasters all over the world have highlighted the vulnerability of the built environment. Scholars have long been concerned with the destructive nature of these disasters in the built environment, and understanding how buildings and infrastructure facilities can be enhanced to mitigate the natural and human disasters. Others have also examined the capacity of human and physical systems to respond to these extreme disasters. More recently, there is a growing interest in developing a more nuanced explanation of building resilience in the built environment, by challenging conventional norms in the recognition of what constitutes building resilience. Additionally, the interest for building resilience and its importance for enhancing sustainable development is also growing.

Therefore, this workshop seeks to bring together doctoral researchers working on projects associated with building resilience and sustainability that supports built environment development to debate on contemporary developments in this area. The workshop will provide an opportunity to ignite fresh theoretical and empirical insights in order to advance what is a fragmented field of study. We welcome contributions made by PhD students into the concepts of building resilience, sustainability development, and associated aspects of resilience and sustainability etc. We also encourage participation by researchers engaging in social science approaches of studying resilience as well as those exploring more fundamental issues such as inter-organisational and project-based contexts of building resilience in construction. Potential research questions that might be useful for discussion at the workshop include: What are the opportunities and challenges associated with building resilience in the built environment, especially during the current financial climate? And how are these shaping working practices in the built environment, in the present and the future? Sustainability has become a new frontier for the 21st century. However, what are the consequences of building resilience in the sustainable agenda? What methodological problems arise when studying building resilience in the built environment? How can the research community contribute to methodological developments in this field of study?

Those that have attended and participated in these workshops in the past will testify to the benefits that they can provide research students at all stages of their doctoral studies. For those who have not attended any of the workshops before, they have three aims: they give the opportunity for students writing PhD theses to present papers and thus benefit from feedback on theoretical and methodological issues raised by their work; they give all delegates an insight into current research; and they provide a chance to meet other researchers working in similar fields.

In achieving these aims, they also help ARCOM to strengthen its contribution to the research community. All construction management PhD students are welcome to attend, as are PhD students from other disciplines who work empirically with the construction industry. The usual format is for five to ten researchers at various stages of their PhD studies to present an outline of their work for about 15 minutes each, with 10 to 15 minutes of discussion for each speaker. We will also be inviting a panel of academic and industrial experts to engage in a plenary debate session at the end of the workshop to discuss the future of research into building resilience. The highlight of the day will be the presentation of two best papers and best presentation awards each worth £100 in book vouchers. The workshop will be conducted alongside the main conference (19th - 21st July) in a special session.

BELLCURVE: Built Environment Lifelong Learning Challenging University Responses to Vocational Education



BELLCURVE
Built Environment Lifelong Learning Challenging University Responses to Vocational Education



Lifelong Learning Programme

EAC
EA
Education, Audiovisual & Culture
Executive Agency

The 2011 International Conference on Building Resilience is being held in association with the BELLCURVE (Built Environment Lifelong Learning Challenging University Responses to Vocational Education) research project.

BELLCURVE is a European Commission funded research project currently being conducted at the School of the Built Environment, University of Salford, UK, in partnership with the Department of Construction Economics and Property Management, Vilnius Gediminas Technical University, Lithuania and the Department of Building Production, Tallinn University of Technology, Estonia. BELLCURVE research project aims to address the mismatches between graduate skills and the construction labour market skills requirements. Construction industry, due to its labour-intensive, multi-disciplinary and highly fragmented nature, relies heavily on the skills and competencies of its workforce. The skills requirements in construction industry are of a dynamic nature, demanding the professionals to continuously improve their skills and competencies. Higher Education Institutions (HEIs) are required to consider such emerging educational needs.

In addressing this, BELLCURVE considers 'student engagement' as a continuous through-life process rather than a temporary traditional engagement limited by the course duration. This through-life studentship defines the essence of the new innovative 'lifelong university' concept, whereby providing an opportunity for learners to acquire and develop skills and knowledge enabling responds to changing construction labour market needs on a continuous basis. BELLCURVE aims to promote the concept of 'lifelong university' in modernising HEIs. As a result, universities can become significant players in the economy and be able to respond better and faster to the demands of the labour market.

The formal learning approaches mainly catered for by the HEIs act as barriers to respond effectively to the frequent and continuous changing needs. Lifelong learning approach is suggested as the more suitable way of responding to such needs. Lifelong learning approach can accommodate non-formal and informal learning elements in addition to formal learning. However, the current systems of HEIs are not flexible enough to fully embrace a lifelong learning model. This suggests the need for reform in the system to make it more responsive to the changing skills requirements and to make the HEIs continuing education centres. In this context BELLCURVE focuses on governance reforms in HEIs delivering Built Environment programmes across the EU, emphasising the ERASMUS programme's objective "to contribute to the development of quality lifelong learning and to promote high performance, innovation and a European dimension in systems and practices in the field". The objectives of this project are

- to develop a framework for HEI's to promote the concept of lifelong university in capturing and responding to labour market skill needs in the Built Environment
- to refine, test and validate the developed framework through existing HEI Built Environment sectors such as Disaster Management, Quantity Surveying, Construction Management and Civil Engineering
- to provide recommendations on governance reforms for HEIs to become 'continuing education centres' for graduates while responding to labour market skill needs.

Workshop on Lifelong Learning needs for Disaster Management Education in the Built Environment

The focus of the workshop conducted as part of the 2011 International Conference on Building Resilience will be on disaster management educational needs and lifelong learning in the Built Environment.

Disasters cause considerable damage to the built environment globally. Therefore the capacity to withstand, respond, recover, rebuild, or reinstate the built environment affected by disasters is a key requisite for achieving disaster resilience.

The skills and knowledge domain of disaster management is multi-disciplinary and complex. It requires integration of technical, social, economic and many other domains. The success criteria expected from disaster management varies according to type of disaster, resultant damage, context, time, etc. Disaster management is a continuous process and has no specific end point. Therefore the continuous development of disaster management related knowledge and skills of built environment professionals is vital.

HEIs delivering Built Environment programmes are required to play a key role in ensuring that the continuous educational needs of built environment professionals are catered for. However, most of the current teaching and engagement mechanisms of HEIs are geared towards one-off formal learning methods. Since disaster management requires a more continuous engagement with built environment professionals, lifelong learning approaches are more suitable.

Organisation for Economic Co-operation and Development (OECD) emphasises that the countries qualification systems need to be able to change and evolve to meet rapidly-changing needs in the world of learning and in the labour market. This demands HEIs to ensure continuous supply of knowledge and skills to those in need to effectively perform in the industry. Lifelong learning approaches will also facilitate HEIs to function as continuing education centres providing skills and knowledge in a dynamic environment.

At a time when the higher education sector itself is undergoing significant reforms, this workshop will provide an excellent opportunity for the participants to engage and benefit from a leading edge research endeavour. In addition to engaging in the development of the BELLCURVE framework, participants will gain more insights to the current and future of disaster management education, HEI reforms and the latest findings of this research so far. Materials and the outcomes of the workshop will be made available to the participants.

Project website: www.disaster-resilience.salford.ac.uk/bellcurve/

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1918
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BELLCURVE research project is being conducted with the financial support of the Lifelong Learning Programme of the European Union.

CEREBELLA: Community Engagement for Risk Erosion in Bangladesh to Enhance Lifelong Advantage

Bangladesh is being identified as a country that is more vulnerable to climate change and subsequent natural disasters such as cyclones, floods, storm surges, droughts, and tornadoes. Dense population and poverty has reduced the adaptability of Bangladesh in disastrous situations thus further increasing severity of disasters. Dangerous zones to hazards such as unstable hills, slopes subjecting to landslides, flood plains, coastal areas, cyclone prone areas are selected as settlements by most of the communities in Bangladesh due to lack of alternatives, affordability or because of the livelihood patterns and income source. Evidence around the world and specifically with reference to Bangladesh suggests that most of the cities are still not prepared to cope up with hazards and climate change threatens. When a disaster occurs, most of the communities overwhelm their coping capacity and damage the long-term development of the community due to the use of resources for disaster relief and recovery activities that could have been used for poverty reduction and economic development. Unplanned disaster recovery and response efforts requires significant amount of resources which can be used for the development of the community. In addition to the coping capacity of the community, Bangladesh is increasingly aware of the importance of education and research on disaster management and climate change adaptation, thus increasing efforts are being made to streamline preparedness, response and recovery mechanisms at all levels.

CEREBELLA, a project funded by the British Council INSPIRE strategic partnership, promotes the UN disaster resilient city concept by getting the involvement of communities in designing and engaging in disaster risk reduction and climate change adaptation activities to develop a strong local information base on hazards, vulnerability and risk of community. Patuakhali region in Bangladesh is used as a case study to carry out this study as this region is highly affected by natural hazards. Accordingly the aim of the project is to create long-term sustainable and strategic partnership between Patuakhali Science and Technology University (PSTU) and University of Salford to share skills, knowledge and experience on climate change and disaster management academic learning and research.

Objectives of the project:

1. Carryout hazard, vulnerability, risk analysis and develop risk response strategies for disaster risk reduction and climate change adaption with the engagement of community and local authority of Patuakhali, Bangladesh
2. Make recommendations for urban safety planning based on disaster risk and climate change impacts of Patuakhali, Bangladesh
3. Update and develop undergraduate/postgraduate curriculum on disaster risk reduction and climate change adaption
4. Facilitate staff exchange and training programmes to enhance capacity of partner institutions to develop knowledge, competencies and international research skills

Project Team

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Reconstruction for Peace

While war in the N&E of Sri Lanka has ended, peace, especially sustainable peace, is not so easily forthcoming. Post-conflict reconstruction supports the transition from conflict to peace through the rebuilding of the socio-economic framework of the society. However, there is a need to pay special attention to conflict dynamics that may arise through development work. Interest in helping to support a lasting resolution to the Sri Lanka conflict has led some to focus efforts on strengthening incentives for peace and reconciliation, including encouraging conflict sensitive approaches and supporting post conflict recovery & reconstruction. Physical infrastructure – broadly defined to include services that are essential ingredients to quality of life and economic activity – has the potential to connect or divide communities. Reconstructing physical infrastructure after a war can help in the peace building process through restoring dignity, providing much needed employment opportunity and promoting conflict sensitive approaches. Any physical reconstruction needs to be tailored to the needs of the affected people, including diverse ethnic groups. Precautions need to be taken to avoid repeating mistakes that occurred during post tsunami reconstruction efforts – lack of consideration of ethnic co-existence. Conflict also tends to deepen gender discrimination and disadvantages faced by women. Similarly, youth, who have been born into and often participated in the war, must overcome persisting inequalities and differential access to opportunities, while the elderly face challenging economic constraints and often require special care. There is growing recognition that reconstruction requires inter-disciplinary solutions; those professions traditionally involved in reconstruction of infrastructure – the construction industry – must understand the sensitive environment in which they will be operating. Understanding the needs of those living in the region will be vital if reconstruction is to help prevent future conflict.

Reconstruction for Peace is a one-year programme of research and capacity building that seeks to explore the interaction between youth and infrastructure reconstruction programmes in the North and East of Sri Lanka as a means to prevent future conflict in the region. The team are from University of Salford, UK (Dr Richard Haigh, Professor Dilanthi Amaratunga & Professor Martin Hall), University of Colombo, Sri Lanka (Professor Siri Hettige), University of Jaffna, Sri Lanka, and Eastern University, Sri Lanka. The project is advised by the Chamber of Construction Industry Sri Lanka and funded by the UK Foreign and Commonwealth Office. The team will specifically examine: 1) how reconstruction programmes engage, employ, connect and divide youth in the region; 2) the extent to which inequality in access to infrastructure affects social cohesion among youth; 3) the factors of infrastructure reconstruction programmes that are most sensitive to impacting conflict prevention. The study will be used to inform policy development and build the capacities of: Universities in the North and East of Sri Lanka; and, the Sri Lankan construction industry (including SMEs) and local government engaged in reconstruction projects within the region.

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Awards

Awards for the Conference are generously donated by Emerald Publishing Limited:

- Best Paper Award sponsored by the International Journal of Disaster Resilience in the Built Environment
- Best Paper Written by a Postgraduate Researcher Award sponsored by the International Journal of Disaster Resilience in the Built Environment

Special Issue of the International Journal of Disaster Resilience in the Built Environment

Authors of selected papers will be invited to submit extended versions of their papers for inclusion in a special issue of the International Journal of Disaster Resilience in the Built Environment. Papers will be short-listed on the recommendation of the International Scientific Committee. The Journal's Editors will then be invited to select invitees for the Special Issue. Further details will be announced at the Conference.

General Information

Sri Lanka

Sri Lanka is an island situated in the Indian Ocean, at the base of the Indian Sub-Continent, 880 km north of the equator. It is a multi-ethnic, multi-religious country with a diverse and rich culture.

Sri Lanka's history is incident full, being an important trade port and oasis of nature for sea farers of China, Arabia and Europe of the ancient times. Sri Lanka has a fascinating documented history over 2500 years of Civilization. The most valuable source of knowledge for the legends and historical heritage of Sri Lanka is the Mahavamsa (Great Genealogy or Dynasty), a chronicle compiled in Pali, in the sixth century.

Sri Lanka is one of the first five gem bearing countries in the world (the other four gem bearing countries are Brazil, Myanmar, South Africa and Thailand). The principle gems of Sri Lanka are rubies and sapphires, while alexandrite, though not so profuse, is found only in Sri Lanka and in the ural mountains of the former Soviet Union.

Sri Lanka (formerly known as Ceylon) is about half the size of England and lies close to the southern tip of India and near the equator. From the coast, the land rises to a central massif more than 1500 m above sea level. The climate is hot and humid - monsoon from May to September and the north-east monsoon from November to March: rainfall, particularly in the south-west, is heavy. Sri Lanka was severely affected by the tsunami on 26 December 2004, which killed some 40,000 people and displaced 400 – 500 thousand people along two thirds of the north-east, south and south-west coastline. Half the fishing fleet was destroyed, and a quarter of hotels in the affected areas sustained serious damage.

Time: Sri Lanka's time zone is GMT +5:30 hours

Government: Unicameral Parliament with Executive presidency

Area: 25,332 sq miles (65,610 sq km)

Population: (2006 est.): 20,222,240 (growth rate: 0.8%); birth rate: 15.5/1000; infant mortality rate: 14.0/1000; life expectancy: 73.4; density per sq mi: 809

Commercial Capital and largest city (2003 est.): Colombo

Legislative and judicial capital: Sri Jayawardenepura Kotte

Main exports: Clothing and textiles, tea, gems, rubber, coconuts

Languages: Sinhala 74% (official and national), Tamil 18% (national), other 8%; English is widely spoken and is studied as a compulsory secondary language in school.

People: 73.94% Sinhalese, 12.7% Tamil, 7.1% Muslim, 5.5% Hill Tamil, and 1.5% other

Languages: Sinhalese, Tamil, English

Religion(s): Buddhist (69.3%); Hindu (15.5%); Muslim (7.5%); Christianity (6.9%), other (0.8%)

Currency: Rupee, divided into 100 cents

Literacy rate: 92% (2003 est.) The highest in South Asia and second highest in Asia.

Member of Commonwealth of Nations

Climate: Sri Lanka has a pleasant tropical climate: the average temperature of the low lands ranges between 25-30 degrees Celsius.

GDP: Sri Lanka's Per Capita GDP is presently US \$1,160 (World Bank, 2006) - the highest in South Asia

Conference venue

The conference venue is the Heritance Kandalama hotel. Occupying a most unique site in the cultural triangle's heartland, the Geoffrey Bawa designed Kandalama Hotel is flanked by two UNESCO world heritage sites - the 1st Century BC Dambulla rock temple and the 5th Century AD Sigiriya rock fortress. The hotel is surrounded by rocky outcrops, lakes and forests, and is home to a variety of indigenous birds and wildlife.

Geoffrey Bawa is Sri Lanka's most prolific and influential architect. His work has had tremendous impact upon architecture throughout Asia and is unanimously acclaimed by connoisseurs of architecture worldwide. Highly personal in his approach, evoking the pleasures of the senses that go hand in hand with the climate, landscape, and culture of ancient Ceylon, Bawa brings together an appreciation of the Western humanist tradition in architecture with needs and lifestyles of his own country. Although Bawa came to practice at the age of 38, his buildings over the last 25 or more years are widely acclaimed in Sri Lanka. The intense devotion he brings to composing his architecture in an intimate relationship with nature is witnessed by his attention to landscape and vegetation, the crucial setting for his architecture. His sensitivity to environment is reflected in his careful attention to the sequencing of space, the creation of vistas, courtyards, and walkways, the use of materials and treatment of details.

The architecture is stark and understated, emphasising the idea that this is not a building to look at, but a building to look from, like a giant belvedere. If they really try, guests can escape onto terra firma, though neither the architect nor the management ever intended that they should do so. They are marooned in a huge ocean liner with decks above and cabins below that has come to rest like Noah's Ark on some faraway mountain side. The only obvious contact with the ground is at entrance level, where the lounge opens towards the main swimming pool, which seems to hang like a shelf on the edge of the cliff. The materials used in the public spaces are cool and hard and work with the large expanses of naked rock to convey an appropriate feeling of austerity that contrasts with the lushness of the encroaching vegetation: one might be inside an evocation of King Kasyapa's Palace. The ample rooms, dwarfed by the generous corridors, function as cells that look out across the tank towards the horizon; even the bathrooms share the view. The Kandalama Hotel offers a unique experience to its guests and stands as the remarkable achievement of a seventy-five-year old architect and his team of youthful assistants

Source: Robson, David. 2002. Geoffrey Bawa: The Complete Works. London: Thames and Hudson

ABSTRACTS

Book of Abstracts

Introduction

This section contains the abstracts of papers submitted to, double blind peer refereed and accepted for the International Conference on Building Resilience, 2011.

In addition to welcoming the more traditional research paper, the International Conference on Building Resilience also invited the submission of abstracts for practice notes and case studies, particularly from Policy Makers and Practitioners who operate in related fields. Authors of accepted practice notes and case studies were invited to present the detail of their abstracts at the Conference.

The book includes 109 abstracts by scholars, policy makers and practitioners around the world. The full papers are available on an accompanying USB drive.

An index of authors is provided at the end of the book.

A community development approach to disaster relief and recovery: Lessons from the tsunami disaster in Sri Lanka and Southern India

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There have been frequent calls within the international literature for a bigger effort to put disaster-affected communities in the 'driving seat' of disaster relief and recovery and international humanitarian agencies working in Sri Lanka after the 2004 tsunami operated under an agreement which specified such an intent. However, most scholars and commentators agree that the practice has rarely lived up to the rhetoric of 'community participation' and a general failure to adequately engage local communities in the post-tsunami recovery effort in both Sri Lanka and southern India has created new tensions, divisions, and social problems within and between affected communities. This paper is based on an intense study of post-tsunami recovery in five local areas in Sri Lanka and in metropolitan Chennai, conducted in partnership with the Australian aid agency AusAID. It argues that agencies working with disaster-affected communities need to have a clear understanding of how a transition from relief to long-term social recovery can work and it suggests a more patient and 'deliberative' approach is needed for the latter. In conducting their research fieldwork, the authors went in search of 'good practice' in implementing a community development approach to disaster recovery and they were surprised to find that some of the best practice was carried out by organisations with no previous experience in disaster recovery. The key ingredients for their success were patience, an ability to get beneath the 'noise' generated by lobbyists and opportunists, an ability to identify community members who represented the interests of key sectors of the community, and persistence in the face of great difficulties and frustrations. The paper argues that it is essential to get beyond shallow understandings of what constitutes a 'community' in order to carry out effective consultation and 'engagement' with a wide range of people and organisations. Local knowledge is certainly critical for success but consultation needs change in the transition from relief to long term recovery and there is a clear role for 'outside' experts to work in partnership with local people and organisations in order to ensure that 'resettlement' is adequately planned and implemented.

Keywords: community, disaster recovery, local knowledge, partnerships, consultation and engagement

ID: 11

The fifth elevation, a forgotten space. What could be the most effective use of roofs in dense urban areas?

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London currently faces two major challenges to its built environment. Firstly, the government's requirements for all new builds to be zero carbon by 2016 is going to be a major challenge for architects and developers alike, and secondly, the on-going densification of London, a trend which has continued since the advent of the green-belt policy, is resulting in a reduction of the number of public, social and recreational spaces in the city. As a consequence of population growth, Urbanisation and government policies, more building stock will be needed in the near future and since the current city policies forbid outward expansion, people will be living at higher densities when compared to the current situation. The good news is that this means there will be a per person energy reduction resulting from lower infrastructure costs and reduced car dependency. The bad news is that, the increase of the cities' density could cause some serious problems to the environment, energy resources and even social well-being. Other negative implications could be increased energy demand from the construction and operation of new dwellings and a reduced availability of land. It is believed that energy consumption could be reduced in-part, through more energy efficient building stock and, that alone could help to reduce the environmental impact of densification, but one thing that reducing energy consumption alone cannot tackle, is compensating for the social spaces lost to the community, through the densification processes. We need to look for places where as architects, we can respond to the negative social and environmental effects of densification, as well as combating Climate Change. What if we could do these things using an area which exists on every single building, an area of our built environment most of the time forgotten and neglected by the city, surely it, could do more than just act as a simple shelter, what if it could be used to replace some of these lost places? This area is the roof, the fifth elevation of the building. In this paper the above urban opportunities and challenges for use of roofs will be explored and, followed by testing and critiquing related technical issues, standards and recent government theories on a smaller scale city block in London.

Keywords: green roof, energy, densification, social interaction, environment

ID: 20

Challenges of sustainable development in the construction industry

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Sustainable development is aimed to reach a stable social and economic development in harmony with nature. Against all these aspects: social, economic and ecological, the construction industry is a major player. The construction sector includes building and civil engineering and all their life cycle phases: construction, operation, maintenance, repair, renewal, demolition and recycling. Environmental issues have become very sensitive throughout the Middle East in the last decade. Pressures on natural resources generated by both economic and demographic growth have reached in some cases a level that may threaten the possibilities of further development in a short-term horizon. The necessity of assuring both human and environmental sustainability of economic development paths has become one of the main concerns of the international community in the last two decades. As the processes of untamed industrialization, urbanization and globalization bear risks on human health, on community structures and institutions, and on the environment. The necessity of redefining development in a more human and environmentally friendly fashion has imposed itself as the major challenge of the next century for all the nations and people of the world. The current stage of infrastructure and economic development in Palestine provides an opportunity to incorporate environmental provisions into the national development strategies from a relatively early stage, rather than attempt retrofit to strategies. Therefore, a comprehensive policy framework and realistic implementation measures are needed. A review of concepts of sustainable development in construction industry is given in this paper and some critical comments are made. This paper reviews the resolutions and declarations of recent international conferences on the environment. The paper concludes that the challenge for the construction industry is to re-engineer its entire process in order to reduce its impact on the environment.

Keywords: sustainability, construction, development, resources, challenges

ID: 23

Subcontractor's selection practice in the Gaza Strip

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Construction contracting involves subcontracting. The evolution of subcontractors has a substantial impact on the construction process. An increasing amount of building construction projects are contracted to subcontractors. Despite the significant role that is played by subcontractors, little attention has been paid to the selection process of specialty contractors. The aim of this study is to identify and evaluate the main effective factors considered by general contractors in the selection of subcontractors. This study is based on a questionnaire survey of thirty-one main contractors in the Gaza Strip. The results indicate the most important effective factors in subcontractors' selection are project size and complexity, applying specification and quality, compliance with programming and quality, experience of subcontractor, and nature and specialty of subcontractors.

Keywords: subcontractor, contractor, selection factors, construction

ID: 24

Doing fieldwork in disaster areas: nurturing the embodied for analytical insight

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This paper recounts my fieldwork amongst tsunami victims in east Sri Lanka and Chennai, South India from 2006 through to early 2010. The fieldwork coincided with the intensification of the long-drawn civil war in Sri Lanka and the subsequent tensions in Tamil Nadu, responding to the plight of Tamils in Sri Lanka. This fieldwork was an integral part of a study of post-tsunami recovery in Sri Lanka and India that was conducted together with Dr. Martin Mulligan over a period of four years using a combination of quantitative and qualitative research methods. The people in the places where I was conducting fieldwork were not just recovering from the traumatic impact of the tsunami, but also dealing with the intensification of the civil war. For these communities, it was an overwhelming feeling of grief, despair and fear; especially for those who remained marginalised by inequitable recovery measures and rebuilding inefficiencies and blunders. In this article, I want to discuss the challenges of conducting fieldwork in such situations of conflict and natural disasters, where fieldwork inevitably involves an ethnographic immersion in the life of traumatised victims that is not only draining, but also emotional and politically demanding. To be able to critically reflect on what it means to participate and share the emotions and political angst of the individuals whilst maintaining an analytical capacity may appear contradictory. But I want to argue that such an ambiguity or apparent contradiction is in fact, critical and useful. It may be the only way to grasp the experiential and embodied dimensions of human behaviours within disaster or conflict situations. It could be these very radical disjunctures between different sorts of emotional flows and uncertain landscapes that can build on a capacity to recognise, empathise and critically reflect; and deepen analytical insight.

Keywords: fieldwork, emotions, ethnographic practice, embodied, disjuncture

ID: 25

Poverty and economic support: the case of Samurdhi programme in Sri Lanka

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Despite Sri Lanka has achieved impressive results in human development indicators over the decades, continuously it has encountered difficulties in its battle against poverty. Since the independence, the country has recovered significantly, mainly through the implementation of various social assistant programmes. However, the poverty in Sri Lanka is still widespread and acute, and is generally a rural phenomenon. Poverty reduction has been slow due to widening inequalities among income groups and across regions. Sri Lanka has a long history of social programs and of food subsidies in particular. Like many other countries, the government of Sri Lanka has a number of social assistance and poverty alleviation programs. The largest one of these is the Samurdhi program, which was introduced in 1995. The main objective of Samurdhi is to ensure the participation of the poor in the production process by increasing access to resources for self-employment, enhancing their health and nutritional status as well as improving rural infrastructure. Based on the empirical analysis of the distributional outcomes, Samurdhi does not emerge as an efficient transfer program. It is modestly successful in reaching the intended beneficiaries, but it transfers a large portion of its resources to the non-poor. Moreover, the non-randomness of its targeting errors indicates that the program would need extensive redesign in order to improve its efficiency. This paper presents a description of the structure of Samurdhi and examines its design and targeting outcomes. In light of these results, the paper intends to stimulate a discussion of whether this program is an effective vehicle for reducing vulnerability and poverty alleviation by using the secondary data from Department of Census and Statistics and various Central Bank Report.

Keywords: human development, poverty alleviation, Samurdhi programme

ID: 26

Building community disaster resilience through a virtual community of practice

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Purpose - This paper discusses a pilot project-in-progress which promotes community-based research (CBR) as a tool for disaster resilience planning. Using transdisciplinary approaches, this project demonstrates resilience-oriented emergency planning with Canadian pilot communities through the co-design of a Web 2.0 'Virtual Community of Practice' (VCOP).

Design/methodology/approach - The VCOP is designed with communities to facilitate knowledge exchange mobilization for emergency planning. Building a culturally appropriate disaster resilience process is an iterative 'process of discovery' and community engagement. Through CBR the project supports practitioners and volunteers to share promising practices and lessons-learned for disaster resilience planning.

Findings - The Virtual Community of Practice will be developed in 2011 – 2012 in 8 urban, remote, coastal pilot sites across Canada. This paper provides an overview of the design and 'proof of concept' work currently underway.

Research Implications - Influenced by American adult educator Etienne Wenger, the VCOP entails co-design and co-ownership of a knowledge engagement process; one which enables local 'thought leaders' to co-develop resilient disaster planning and practice. The VCOP provides a communication platform and fosters 'foresight' planning and 'education for critical awareness' (Freire, 1973). Through the sharing of theory and practice i.e. praxis, communities are mobilized and empowered to anticipate future risks and plan for resilient recovery.

Practical Implications - VCOP challenges the status quo design and delivery of emergency management protocols from traditional 'centres of knowledge and power' e.g. governments and universities, and fosters community-driven planning for risk assessment planning and disaster recovery.

Originality/value - The novel application of a Virtual Community of Practice to disaster emergency planning is in keeping with the spirit and principles of UNISDR's Hyogo Framework for Action 2005 – 2015. VCOP has potential to demonstrate disaster resilience 'foresight' planning as evidenced in the adoption of promising ideas and practices developed by communities, for communities. As Louis Pasteur once said "Chance favours the prepared mind".

Keywords: resilience, virtual community of practice, community empowerment

ID: 28

New Zealand engineering practice on resilience of building structures

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We nowadays live in a fast changing society, the potential hazards, which the built environments are to be subjected to, will inevitably increase and the human-induced hazards are becoming more prevalent especially when we take a proactive approach to think ahead to assure the adequacy of our built environment to meet the future needs of our fast changing society. The design of individual building, which is part of the built environment, has to take into account the implications associated with the surrounding built environment. There has been increased research developments worldwide in recent years in the resilience and sustainability of built environment. Lots of research has been on two aspects: potential hazards and the integrated capacity of built environment to cope with the hazards. Built environments vary a lot in scales and the components. A built environment can consist of essential facilities (hospitals, so on), utilities, building structures and infrastructures. Among these, resilience of building structures is the vital part of the resilient built environment and catastrophic structural collapse of the building structures is the greatest threat in causing casualties and economical loss especially when the affected population is large, necessitating the need for a great resource of emergency response and recovery effort. Therefore resilience of the built environment is significantly dependent on the resilience of the building structures. In the past disaster events, natural or human-induced disasters, the observed evidence frequently shows that inadequate allowance in structural design for the surrounding built environment or for the factors beyond the code explicitly specified actions are the factors for failing the resilience of the building structures when the buildings or the built environments are subjected to extreme events. The paper presented here is to examine the current NZ regulations and general structural engineering practice in terms of resilience of the building structures, and to identify the areas where improvements and efforts can be made to achieve the resilience of the building structures and therefore the resilience of our built environment.

Keywords: resilience, building structures, built environment, human-induced hazards

ID: 30

Disaster waste management following the 2009 Samoan Tsunami

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The 2009 Samoan Tsunami killed 143 and affected 4389 people. Before communities could begin to rebuild, the tonnes of potentially hazardous (to public health and the environment) debris had to be removed. Interviews were conducted with professionals involved in, and affected by, the tsunami debris clean-up in April 2010. A number of government and international non-governmental organisation initiated clean-up programmes in affected communities. Terrestrial waste clearance was prioritised ahead of coast, marine and wetland areas. Generally a combination of community and contracted labour was used during the clean-up. Some material was salvaged for temporary shelter and recycling, however, the majority of the waste was disposed of at Tafaigata landfill. An overall strategy and strong leadership in waste management activities was absent – leading to a string of discrete, nonstrategic and varied interventions. There appeared to have been no overall coordination, and no waste management strategy from the international community, or the Government of Samoa's Ministry of Natural Resource and Environment (MNRE). The MNRE lacked the physical and financial resources and oversight to deal with the waste efficiently and holistically. In the future a more coordinated approach would be beneficial. Key waste programme components such as financing, waste management programme implementation and environmental standards varied between organisations and there was little cohesion and consistency. This resulted in mixed and incomplete outcomes from the clean-up works. Inconsistencies included: varying levels of recycling; expectations on community participation in debris cleanup (paid and non-paid; waste segregation vs. mixed waste collection); different standards in clean-up service provided between villages.

Keywords: Samoan Tsunami, waste, debris, disaster management, humanitarian coordination

ID: 31

Implementing a disaster recovery programme: a demolition and debris management perspective

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The timeliness and quality of recovery activities are impacted by the organisation and human resourcing of the physical works. This research addresses the suitability of different resourcing strategies on post-disaster demolition and debris management programmes. This qualitative analysis primarily draws on five international case studies including 2010 Canterbury earthquake, 2009 L'Aquila earthquake, 2009 Samoan Tsunami, 2009 Victorian Bushfires and 2005 Hurricane Katrina. The implementation strategies are divided into two categories: collectively and individually facilitated works. The impacts of the implementation strategies chosen are assessed for all disaster waste management activities including demolition, waste collection, transportation, treatment and waste disposal. The impacts assessed include: timeliness, completeness of projects; and environmental, economic and social impacts. Generally, the case studies demonstrate that detritus waste removal and debris from major repair work is managed at an individual property level. Debris collection, demolition and disposal are generally and most effectively carried out as a collective activity. However, implementation strategies are affected by contextual factors (such as funding and legal constraints) and the nature of the disaster waste (degree of hazardous waste, geographical spread of waste etc.) and need to be designed accordingly. Community involvement in recovery activities such as demolition and debris removal is shown to contribute positively to psychosocial recovery.

Keywords: disaster recovery, disaster waste, disaster management, human resourcing; public participation

ID: 32

Restorative drying improves building resilience

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Despite acceptable design, construction, and operation, disastrous events which do not immediately destroy a building can impose or permit conditions that might degrade its resilience. Water losses are common to many disasters. Riverine flooding, hurricane storm surge, tsunamis, and precipitation through failures of the building envelope all lead to structural water losses. Some losses cannot be restored, so damaged buildings must be demolished and reconstructed. Yet, modern equipment and techniques enable contractors to restoratively dry other structures to their pre-event condition and reduce the number and severity of water losses. Restorative drying equipment and techniques are reviewed to provide the reader insight about an aspect of building resilience that is not commonly known. Better knowledge of these techniques by designers can lead to incorporation of materials that lend themselves to easier restorative drying and, therefore, better building resilience. Better knowledge of these techniques by constructors can lead to a larger number of companies with proper equipment and trained workforces by which to respond more comprehensively to water losses and ensure better building resilience.

Keywords: restorative drying, structural water loss

ID: 43

A Buddhist approach to disaster recovery and resilience in Sri Lanka

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This paper explores the idea of a Buddhist approach to disaster recovery through case studies of two Buddhist non-government organisations that worked in the 2004 Indian Ocean tsunami recovery in Sri Lanka. Buddhism claims influence over millions of people's worldviews, including most of the population in Sri Lanka. This religion has within its own philosophical framework an approach to disaster definition, recovery and resilience and can potentially make a significant contribution to disaster research by offering a perspective that is currently very much overlooked. The paper begins with a deep understanding of the Buddhist philosophy to illicit three key concepts that are particularly resonant to the perception and experience of disasters: human suffering, dependant arising and compassion. Extending from these concepts a Buddhist perspective is presented that describes disasters as a sudden and heightened level of human suffering with its processes of recovery and resilience resting heavily on the holistic attention to the physical, emotional and spiritual dimensions of the survivors. Through the case studies of the Sarvodaya Shramadana Movement and the Buddhist Compassion Relief Tzu Chi Foundation, the aim of the research is to tender a new area of study within the disaster literature specifically focused on religious approaches to recovery and resilience. These two case studies are not only the largest non-government organisation indigenous to their respective countries, Sri Lanka and Taiwan, but also have strong Buddhist practices that inform their approach. The pursuit of this study builds upon the existing research in the area of religion and disaster studies. This includes an established Christian literature on disaster management, as well as empirical studies in disaster sociology focused on religious communities. The research also intends to build on the Buddhist disaster literature by extending a strong foundation of theological principles and a growing 'socially engaged Buddhist' literature. It is the hope that insights from this exploratory research will encourage future studies in the area in order to be able to draw broader conclusions about religious dimensions of recovery and resilience that are also applicable to secular and government practices.

Keywords: religious NGOs, post-disaster, recovery, resilience, Buddhism

ID: 52

Alternative resilient livelihood option for fisher-folks Tsunami victims: special to Batticaloa district

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Fisher folk belongs to east coast of Sri Lanka have been the most affected by the 2004 Indian Ocean tsunami. The aquatic diversity of the region has also been devastated by the tsunami. Mangroves and coral reefs have been relentlessly destroyed, not only taking away the protective barriers from the massive waves but also reduce the coastal breeding grounds for finfish, shellfish and other aquatic organisms. Fisher folk are amongst the poorest people in the region and suffered tremendous loss of life and also devastation to their livelihoods. They are also one of the most negatively affected communities. Many are still fearful of returning to the sea and suffer from extreme post-disaster trauma. Suddenly increase of the post-tsunami restoration programs increases the pressure further on the coastal environment and its resources. The restoration ensures access to more diverse and better targeted credit to fishermen came in light by introducing alternative livelihood options of seaweed farming, crab fattening and milk fish farming in floating cages would be not only re-establishing their livelihood but also alternative to depleting fish from the coastal belt and sea. Moreover enhancement of spawning and feeding grounds by conservation and re-plantation of mangroves is a way to ameliorate an environmental pressure. This project was funded by Canadian International Development Agency (CIDA) in the name of Tsunami Restore Project from January 2007 to March 2009 in collaboration with Eastern University, South Eastern University, Ruhunu University and Canadian Universities. Through the Participatory Rural Appraisal (PRA) method Paalameenmadu and Puthukudyiruppu were selected as worst tsunami affected areas as project implement sites. The restoration of their livelihoods via community based project was initiated in both villages of Batticaloa District to the fishermen for proper utilization of available resources in their region and along with the increasing opportunity for additional income generation other than fishing in an environmental friendly way.

Keywords: appraisal, fisher folk, resilient, trauma, Tsunami

ID: 53

Displacement, resettlement, and development - interrelations and contradictions

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The study seeks to understand interrelationships between key issues of post-displacement scenarios. It is often expected that displaced people go through a set of stages after displacement if steps were taken for displaced to recover from the displacement. Relief, rehabilitation, resettlement and developments are some of commonly referred terminologies found in the literature in this respect. Quite often outcomes of these interrelationships differ from one other and not necessarily follow the sequence of post-displacement scenario mentioned above.

The study is an assessment of two resettlement schemes in Ampara District. Questions asked why and how resettlement scheme becomes a source conflicts in a country like Sri Lanka. Conflict is perceived between perceptions of newly settled families and available opportunities in the place of resettlement. Often settlers compare pre-displacement living situations such as socio-economic and cultural ways of life and livelihood adjustment with the new opportunities that are available in the present location of resettlement.

The study based on case study investigations. Two newly settled resettlement villages from where investigation conducted for the study. Two case study villages are located in an administrative division (called Divisional Secretariat or DS Division) of Ampara District which has experienced series of displacement due to development, war and tsunami in the recent decades. The two settlers, however, were from a traditional village called Olluvil along the Ampara coast.

The study found that majority of the settlers was not very happy about many aspects of life in two newly settled villages. Failure of not fulfilling the expectations of the settlers points to issues such the location selection of the resettlement villages, design of the houses, infrastructure facilities, etc. Those weaknesses, in fact, have caused a new round of conflict instead of creating conflict free life for the resettles according the findings of this study.

Keywords: displacement, resettlement, development, interrelationships, contradictions
displacement

ID: 56

Post-disaster recovery in flagship renewal programs – a case study of T.Vilufushi, Maldives following the 2004 Asian Tsunami

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Accepted post-disaster response programming emphasises the need for increased community resilience and reduced vulnerability to future natural triggers. The “build back better” approach is frequently extolled as the underlying foundation of the accepted recovery paradigm. Such an approach is characterised by incremental improvement to community resilience to future disaster, whereby the post disaster window of opportunity is taken to reduce vulnerability through adaptive measures including improved urban environment siting, physical mitigation, robust construction techniques, disaster preparedness systems and knowledge, gender mainstreaming, livelihood enhancement etc. Community participation in such post-disaster response programs has been identified as a key ingredient to maximising the impact of these measures. This is because the community is best placed through indigenous knowledge to identify their vulnerabilities and adaptive capacities, and also practical and achievable ways in which these can and should be addressed through post-disaster response programs. Flagship renewal programs represent a quantum leap in the post-disaster recovery paradigm beyond build back better. The same window of opportunity is used to implement a response program which is designed to, not only increase resilience and reduce vulnerability, but also has an intentional catalytic effect on the urban, social and economic fabric of the effected community. However, such a program is often driven by the agenda of external stakeholders, requires greater resources, greater time. Potentially, therefore such a response has less opportunity for community participation. This can detrimentally impact upon community adaption and ultimate recovery of a community from a disaster. This paper reports upon research currently in progress into post disaster community recovery within a flagship renewal paradigm, using a case-study from the Maldives following the 2004 Asian Tsunami. Post disaster community recovery is examined using a qualitative research methodology that utilises the four capitals model of sustainable development as the analytical framework. Initial findings of the research suggest that recovery of the community is not uniform across all wealth capitals. Whilst participation is still possible in individual components of a larger scale recovery program, holistically there has been a lack of adaptation by the community which is undermining their recovery.

Keywords: disaster recovery, flagship renewal, four capitals model of sustainable development
ID: 58

Shantitown: building system in bamboo for emergency

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Shantitown is a play word for “Shanti” – meaning “peace” in Sanskrit language – and shantytown. Shantitown is a new concept building system with bamboo which faces the problem of house needing, providing an innovative emergency solution that can substitute the actual ones improving their safety, comfort and aesthetics. Shantitown keeps the principles of an informal settlement, such as low price, autochthonous materials and self construction and furthermore enables people to guarantee the long term safety of their house, so that the role of external charitable associations may be kept minimal. Shantitown is a modular system and each unit (12 x 15 metres) is made with a main bamboo frame, simply tied with natural or plastic ropes thus resembling the Asian scaffoldings. The claddings are made of recycled materials and bamboo crossed panels. The internal structure can provide independent house- and shop-units and its dimensions and materials can be changed. The collection of information about slum reality and necessities has been made mostly on the site, studying one of the biggest slums of the world: Dharavi, in Mumbai. The study of a shantytown from its inside has been useful to understand the real needs in a case of poverty and emergency: the materials chosen for Shantitown are easy to find and cheap, the construction techniques are those already used by local people, the spaces are those needed to live and work. The proposed solution focuses on the main problems that people living in slums face every day or seasonally. The shape of the unit and the materials have been chosen to let the air circulate and create a better climate and comfort. The structural analysis focused on two of the main principles of Shantitown: the durability of the structure as built, checked and maintained in time by local people and the freedom of composition of the secondary structure. A series of analyses has been performed hypothesizing random damage of the beams and checking the main structure stability, finding the best solution for safety and utility.

Keywords: self-build, informal settlement, recycled materials, bamboo structure

ID: 61

Building resilience: understanding the community capacities

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The development agencies have become advocates for more resilient communities on disasters, which are striking unexpectedly anywhere. Several tools have been adopted for carrying out the rapid assessments and planning for the post disaster action plans. The resilience includes human capabilities as well as built environment and early warning mechanism. Disasters occurring in the South, especially in the areas considered as developing countries, are causing long-term damage to humans and infrastructure, which need to be tackled as a long-term development objectives set for building resilience that is based on community capacity building. The objectives include such as organizing and managing the disaster risk reduction (DRR) related assessments, planning and later implemented activities. Communities living at the high-risk zones should be included though they have not faced actual disasters. Community capacity building projects on disaster risk reduction have become one of the mainstreaming themes nowadays. How the people in the communities see the risks and what are their understanding about disasters and the reasons why they occur in higher intensity? These are the questions to be researched in both communities: those who have experienced the disaster, and within those living in the similar environment and social setting but so far disasters have not caused remarkable damage in the vicinity. A study of local understanding of the disasters and causes of them helps development workers to figure out the key obstacles and success factors when the resilience is build and communities are facilitated into the processes for becoming more resilient and aware of risk reduction needs at the local level and concept. My personal research intentions consist of studying the selected communities and find the real “faces” in communities that have faced the climate change related disasters, or at least changed weather patterns causing hazards on inhabitants and environment. The research on the people and their understanding of the disasters and appropriate resilience building would be carried out under the development cooperation work among the people of the affected communities.

Keywords: disaster, development, risk, reduction, capacity

ID: 62

Human elephant conflict in Sri Lanka: special reference to Thanamalvila DS Division

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Many species including Asian elephants face an increasingly conflictual relationship with humans when competing for space and resources. The Elephant habitats are shrinking daily and people are encroaching on the territory of elephants to expand their agricultural lands and habitats leading for a disastrous human- elephant conflict which has eventually evolved in the last few decades, when both species inhabit adjacently in the same area. In Sri Lanka, around 100-150 humans were killed by elephants and around 200 elephants were killed by humans each year. The main objective of this study is to seek the nature of human elephant conflict in Thanamalvila DS division where a higher number of such incidences are censored in the recent years. Primary data in Thanamalvila DSD, including 05 GN divisions, purposively selected according to the highest number of recorded incidents, has been used for the study. 106 households of farming community were selected by using stratified random sampling. Of the 106 adults who were interviewed, 88 were males and 18 females. Farmers represented 83% of the total number interviewed. The study was conducted in September, 2010. GIS mapping and frequency analysis were used in analyzing data. The Study found that 92.5% of households in the sample were arrived by elephants in the last year. The mean times of attacks were recorded as 20times per year. 61% of elephant arrivals were at night. Highly affected crops by elephants were chena cultivation, banana and paddy respectively. Considering the characteristics of families, the majority are low income people representing income categories of Rs.5001-10000 and less than Rs.5000 respectively. Majority of the sample (72%) lives within 2 kilometres distance to the jungle. However only one human death was recorded last year in this selected community. Concerning the other side, one elephant was killed and one was injured in the human-elephant confrontations during the last year, according to people. Most of people used low harm techniques to chase elephants away. 10.4% had used self- prepared weapons to shot elephants. Only 14 % of people were compensated for their losses by government authorities.

Keywords: human, elephant, conflict, Thanamalvila, Sri Lanka

ID: 65

The socio economic impact of forest firing: a case study in Imbulpe DS division (Gomale, Paraviyangala and Havagala Range) in Sri Lanka

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Forest Firing has become one of the major disasters in Sri Lanka in recent history. Some areas in the Ratnapura district including Imbulpe, Balangoda, Embilipitiya, Kollonna and Weligepola DSDs have been identified as high risk areas of forest fires. The main objectives of this study are to identify the risk areas of forest firing in the range of Gomale, Havagala and Paraviyangala and to identify the socio-economic impact of forest firing on community livelihoods. Both primary and secondary data were used for the study. Primary data was collected by using multiple data collection techniques including interviews with farmers and the other communities, university academics, students, and the government authorities including the Divisional Secretary in the Imbulpe DS division. Secondary data was collected from the district disaster management, irrigation, govi Jana seva, forest and wild life offices in the area. GIS mapping was used to identify the risk area of forest firing and the impact was studied by using frequency analysis and some qualitative analyzing techniques. The study found that carelessness of the villagers and domestic tourists in lightening fires, activities of hunters, burnings in Pines cultivation, burning dead grass to obtain new grasses for cattle are the key roots of forest firing in this area. Considering the impacts of forest firing, natural forest area has been decreased by 35 percent (from 2890 acres to 1882 acres) during 1996-2010. According to Govi Jana Seva, the abundant agricultural land has increased from 4 acres to 56 acres in the area due to the lack of water for the cultivation in the same period. The key indirect impact of forest firing on community is the reduction of water levels and the rain fall leading to a huge socio economic impact in the area. Decrease in water level in the Kiriketioya basin during the period of 1990-2010 is on average 0.4 millimeters annually. The daily water consumption was restricted due to this environmental hazard according to the majority of the community. Valuable herbal plants, birds and many other rare species are rapidly dwindling due to this event in the area.

Keywords: forest, fire, impact, imbulpe

ID: 66

The determinants of infant malnutrition at birth in estate sector of Sri Lanka: a case study from Dehiovita estate

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“Sri Lanka despite achieving excellent health indicators remains plagued by malnutrition.” Malnutrition is a problem today but a crisis tomorrow in Sri Lanka (De Silva, 2010). The Estate sector was selected for this study due to high records of malnutrition, infant and child mortality and the highest poverty head count ratio in the sector. The study focuses on the low birth weight children which are recorded as a key group of vicious cycle of malnutrition in the estate sector. The main objective of this study is to identify the determinants of infant low birth weight malnutrition in the estate sector of Sri Lanka. The study used primary data collected by using 100 children selected from 148 children population of less than five years old in Dehiovita estate in Kegalle district, Sabaragamuwa province in July 2010 by using simple random sampling method. Descriptive statistics and Binary Logistic Regression model were used for the study by using dependent variable as 1 for low birth weight child and zero for the rest. Out of 100 children 65 were boys and 35 were girls and 80% of sample was Tamils. 37% of infants were underweight at birth. Mean age at marriage of mother is 21 years in the sample while mean age of delivery recorded as 26 years. Considering employment status of fathers, 46% majority were estate sector workers while 20% were drivers. 52% of fathers were alcohol addicted. Majority of mothers were garment workers estate labourers. Majority of mothers (66%) have pre secondary education. 55% of mothers were employed during the pregnancy period and 23% of mothers were underweight. Family income of 36% families was in between Rs. 10001-15000 rupees. 69% of births were attended by normal delivery. Being underweight mother, having chronic disease to mother, bearing a job at pregnancy duration by mother and father being alcohol addicted have positive significant relationships with infant malnutrition at birth while being a mother with secondary education, family income, mother's age at delivery and mother's height have negative relationship with malnutrition of infant at birth.

Keywords: determinants, infant, malnutrition, birth, estates

ID: 68

Capacity building towards resilience: context of post disaster waste management

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Capacity building provides an opportunity to understand strengths, weaknesses, threats and opportunities towards a resilient future through identification of broader issues around sustainable development of a particular program, project or process, including their unique cultural, social and ecological characteristics. Thus, concept of capacity building is an essential component in development theory and practice. In particular, in post disaster scenarios, focus has been placed upon local capacity building as a means of increasing resilience to natural hazards. In this context, this paper focuses on concept of capacity building and its role in post disaster waste management towards building future resilience. Case studies have been conducted to gather information on existing capacities of post disaster waste management in Sri Lanka. Semi-structured interviews were held as the main data collection method and content analysis was used to analyse collected data. Results of existing capacities and identified gaps of post disaster waste management are presented in key areas as skills and confidence building, links and collaborations, continuity and sustainability, research and development, communication and coordination, organisational implementations and investments in infrastructure. Finally, the paper concludes with proposed recommendations for enhancing capacities of post disaster waste management towards future resilience.

Keywords: capacity building, disaster waste management, post disaster, resilience

ID: 69

Risk and vulnerability assessment – a comprehensive approach

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Disaster risk and vulnerability assessment depends on various factors such as, appropriate theoretical approach, quality and adequacy of information gathered, and community perception - for accurate and meaningful results. Accounting for people's perception and partnering with them in the process leads to deeper understanding of community vulnerability, which in turn provides better assessment of disaster risk: $R \text{ (risk)} = H \text{ (hazard)} \times V \text{ (vulnerability)}$. Risk assessment is essential for prioritisation of various risks in time and space in order to plan for future disaster mitigation measures and resource allocation. This paper offers an integrated approach for risk and vulnerability assessment that includes theoretical disaster models, quantitative risk assessment method, and a component representing people's perception. The two models namely, the pressure and release (PAR) model and the access to resources (ATR) by Wisner et al (2004) offer static and dynamic approaches respectively. The framework recommended in the PAR model is valuable for basic understanding of the progression of vulnerability (in a given time) through identification of root causes such as, limited access to power and resources; dynamic pressures such as, lack of training and education, urbanization and rapid population change; and unsafe conditions such as, dangerous locations. The ATR model complements the PAR model by expanding upon the dynamics of changing decisions, options, livelihood opportunities, budgets, available resources, and choices made by the population that is impacted by a disaster, both temporarily and spatially. The hazard risk and vulnerability assessment (HRVA) tool is a quantitative method to evaluate community risk profile. The representation of people's perception is proposed by introducing an additional factor 'cp' (community perception) in the fundamental risk equation: $R = H \times (V \times cp)$. Integration of above described concepts/methods provides a unique and comprehensive approach to evaluate disaster risk for communities around the world.

Keywords: disaster risk assessment, community perception, pressure and release, access to resources, vulnerability

ID: 72

Transition within transition shelter in Haiti: an issue of structural load levels

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The strategy for shelter response in the humanitarian context is a linear process with firstly emergency shelter followed by recovery/temporary shelter and finally reconstruction/permanent shelter or homes. Emergency shelter consists of tents that have a life expectancy of around 6 months, recovery shelter (often referred to as a transitional or “t” shelter) that has a longer life expectancy of up to 3 years and then final reconstruction which is the long term/permanent shelter or housing. The 3 phases, emergency, recovery and reconstruction are usually seen as 3 distinct phases of the post disaster shelter reconstruction. This paper reports on survey work done during the emergency/recovery phase of the shelter response in Haiti following the earthquake in January 12 2010. The survey showed up that several shelter agencies were incorporating long term permanent structure into their transitional shelter that would subsequently be the structure for the long term/permanent shelter. This was not totally unexpected but the paper then goes on to look at the structural and design issues that need to be incorporated into the recovery shelter for them to be later adapted into permanent shelter. This aspect was not understood by shelter agencies that saw such changes as having strategic rather than any design impact. Nonetheless, if agencies are seeking to reduce vulnerability, to provide durable and resilient solutions than there is a subsequent need for correct design loads for this to be achieved and for “build back better” to be realized. The transition within the transitional shelter the agencies were seeking needed further reflection than was initially appreciated and hence the relevance of this paper.

Keywords: shelter, post disaster reconstruction, transition, recovery phase
ID: 81

How do people go about getting something built in Port au Prince, Haiti?

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The involvement and understanding of communities is at the heart of a “resilient” humanitarian approach in post disaster reconstruction. This paper describes the outcomes from one of two “ethnographically” based surveys of residents from Caradeux camp in Port au Prince, Haiti carried out to understand the building practices particularly in the urban context prior to the January 12 2010 earthquake so that shelter programmes could be more effectively set up.

According to UN Habitat, in 2009 metropolitan Port au Prince housed some 2.7 million with most living in informal settlements where there was no clear title to the land on which their house was built. It affected all sections of the community as land records were essentially non-existent or overlapped. Thus, land tenure was generally insecure. Nonetheless, construction even in poorer communities was almost universally in permanent materials such as concrete blocks, concrete floors and timber doors. Why did that happen in apparent contradiction of commonly held ideas and notions?

A short yes/no survey was constructed and 207 responses gathered from 4 separate surveys of families in Caradeux Camp in Port au Prince, Haiti by the IFRC camp socialization team during September 2010. This report summarises the conclusions from that data but underlines the need for basic surveys early in any recovery phase.

Keywords: land tenure, survey, building culture, shelter

ID: 82

Sustainable solution for the reconstruction of low income housing in post-disaster zone

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This paper approaches the reconstruction of low income housing in a post-disaster zone from the perspective of sustainability. It builds a holistic definition of sustainability for low income housing, based on five key interests: social, cultural, environmental, economic and aesthetics. An Assessment Grid is developed, based on the theory of those five interests and real world experiences, which can be used as a framework for judging the sustainability of an architectural response to low income housing reconstruction, and as a tool to challenge the architect during the design process. The Assessment Grid is applied to develop a sustainable design proposal for the reconstruction of low income dwellings in Pisco, Peru – the site of a devastating earthquake in 2007. The proposal is developed in a real-life scenario, based on data supplied by an NGO working on post-disaster reconstruction in the area, in collaboration with local inhabitants. The Grid is used at each stage of design to highlight the weaknesses and push the design forward. The final design is a demonstration that an architectural solution is possible for sustainable low income housing reconstruction in post-disaster zones. It is also a testament to the usefulness of the Assessment Grid process. The process reveals the importance of future proofing, community participation, flexibility and progressive design.

Keywords: sustainability, disaster zone, low income, housing reconstruction, Pisco

ID: 83

DASS42 survey: Caradeux Camp, Port au Prince, Haiti

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The involvement and understanding of communities is at the heart of a “resilient” humanitarian approach in post disaster reconstruction. This paper describes the outcomes from the second of two “ethnographically” based surveys of residents from Caradeux camp in Port au Prince, Haiti to understand who were most affected by the earthquake disaster that occurred on January 12 2010. A quality of life survey called a DASS42 survey was completed at Caradeux Camp by the IFRC camp socialization team. In all 108 surveys were completed with 18 later being filtered out based on an “extremely severe” check developed by one of the authors. The final number consisted of 61 female and 29 male respondents, 90 in total. This data was analysed using an EXCEL spreadsheet and “characterized” based on the DASS42 severity table and conclusions and implications for recovery shelter programmes proposed. Both papers touch on the key issue of when is enough, enough? And the need for operational necessity against information rigour.

Keywords: quality of life, survey, recovery shelter

ID: 84

The Gabion House approach

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A gabion is a wire cage that is filled with rocks and then stacked usually in retaining wall situations. However, in the case of the Gabion House reported in this paper their use and design was modified to allow them to be stacked to form a load-bearing “masonry” type walls. This shelter/building approach was developed in the post earthquake situation in Port au Prince, Haiti to use the extensive amounts of rubble generated by the January 12 2010 earthquake. The costs and the logistics to remove the rubble were a significant challenge to shelter agencies working in the ravines and valleys typical of the Port au Prince typography. The lack of access meant that the rubble would have to be removed manually and the costs of clearing and dumping were between US\$30 to \$60 per cubic metre. This approach also included the use of hand crushers that allowed further re-use of the rubble for footings, plasterwork and concrete aggregate. Post disaster reconstruction approaches often attempt to reverse the impacts of a disaster by trying to simply rebuild back what was there originally. In a sense it tries to “reverse” the process caused by or resulting from the disaster. However, in many situations where this “reversing” is simply not possible requires instead an innovative approach to get back to where you were previously; to allow any build back better. And this paper presents a possible “operational” example of that in the post earthquake context of Haiti. There are nearly 250+ of these houses in the planning stage as at December 2010 with a proof of principle house constructed and 4 further prototypes testing a 2 storey option currently under construction.

Keywords: housing, seismic, recycling, gabions

ID: 85

Assessing the resilience of potable water supplies in Southeast Queensland Australia

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Historically, cities as urban forms have been critical to human development. In 1950, 30% of the world's population lived in major cities. By the year 2000 this had increased to 47% with further expected growth to 50% by the end of 2007. Projections suggest that city-based densities will edge towards 60% of the global total by 2030. Such rapidly increasing urbanisation, in both developed and developing economies, challenges options for governance and planning, as well as crisis and disaster management. A common issue to the livability of cities as urban forms through time has been access to clean and reliable water supply. This is an issue that is particularly important in countries with arid ecosystems, such as Australia.

This paper examines preliminary aspects, and theoretical basis, of a study into the resilience of the (potable) water supply system in Southeast Queensland (SEQ), an area with one of the most significant urban growth rates in Australia. The first stage will be to assess needs and requirements for gauging resilience characteristics of a generic water supply system, consisting of supply catchment, storage reservoir/s and treatment plant/s. The second stage will extend the analysis to examine the resilience of the SEQ water supply system incorporating specific characteristics of the SEQ water grid made increasingly vulnerable due to climate variability and projected impacts on rainfall characteristics and compounded by increasing demands due to population growth. Longer-term findings will inform decision making based on the application of the concept of resilience to designing and operating stand-alone and networked water supply infrastructure systems as well as its application to water resource systems more generally.

Keywords: resilience, resilient infrastructure systems, potable water supplies, Southeast Queensland

ID: 86

Exposure to natural hazards and forced relocation as a vulnerability reduction strategy: new emerging vulnerabilities among forced resettlers

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Forced relocation of people lived in hazard prone areas into new settlements has been employed as a vulnerability reduction strategy to natural hazards to secure peoples' livelihoods by various governments in Sri Lanka. Nevertheless, it is evident from studies that forced relocation in turn has created new social vulnerabilities among resettlers as some of them are unable to successfully cope with various stress and risks situations created as a result of the shock of forced relocation, while a few resettlers successfully cope with it. In this context, this paper explores how forced relocation of tsunami displaced people lived in the 100 meter buffer zone in the Galle city into new settlements far from the previous place of residence make them vulnerable based on fieldwork carried out in two tsunami relocation settlements in Akmeemana Divisional Secretariat in Galle. Based on the findings from the empirical survey carried out in two relocation settlements situated 10-15 km away from the city of Galle, this paper argues that planners and other relevant officials who were responsible for relocation intentionally or unintentionally have not attempted to reduce risks and stress factors of forced relocation in the planning stage or even soon after relocation. Therefore, this situation has increased social vulnerability of resettlers as majority of them are unable to successfully cope with the situation. However, the author argued that resettlers may need at least five years or more to adapt to the new environment and to get basic facilities to their respective settlements. In this context, the author recommends to minimize such risks and stress factors before relocation or immediately after relocation in order to assist resettlers to adapt to the new environment without problems in order to make relocation a success by reducing new social vulnerabilities.

Keywords: social vulnerability, forced relocation, coping, livelihoods

ID: 88

Information and communication technology for promoting ethnic cohesion in Sri Lanka

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Sri-Lanka is still having conflict affected communities due to military war. In our research we have focused on the use of ICT tools to build community engagement in Sri- Lanka. Our research aimed on joining the people together with use of ICT tools. We suggest a common virtual place, can be used for different ethnic communities to share their interest, thoughts and feelings in a positive manner and finally to build a long lasting relationship among all. For that we propose a social network which can be used to connect people together. The broad goal of this project is to choose the best features of a social network which serves for linking different ethnic communities in Sri-Lanka. Through the proposed social network, we evaluate the effectiveness of social networks on reducing the gap among different ethnic communities and improving the interaction among them. Questionnaire, interviews, discussions and an online survey were used to gather required data in order to come up with the design of our social network. This pilot project was targeted at local universities for the initial stage. Both Qualitative and quantitative measures were used to assess the effectiveness of the interaction among different ethnic communities in the social network site. Due to the time constrain we couldn't arrive at comprehensive conclusion.

Keywords: ICT, interaction, ethnic communities, social network design

ID: 95

Indoor thermal performance of green roof in a tropical climate

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The concept of Sustainable building development has been promoted to overcome the issues occurring due to the energy crisis, environment impacts and rapid urbanization. Minimization of energy usage for achieving a comfortable indoor thermal environment in a building is one of the key elements of sustainable development. However, it is very important to assess the performance of buildings with sustainable elements in tropical countries, where warm humid climatic conditions prevail. As a result, green roof is proposed as a sustainable element for buildings in tropical climatic conditions and its indoor thermal performance was determined experimentally using small scale models. Using those experimental results and literature, large scale buildings were modelled to simulate the indoor thermal performance of sloping traditional roofs, reinforced flat concrete slabs and green roofs. The results have proved that green roofs provide acceptable indoor thermal performance with respect to the other traditional roofs. It was found that the green roofs act as resistive and capacitive insulators, which result in more indoor thermal comfort to the occupants while re-establishing the relationship between human and environment, which have been destroyed due to the rapid urbanization. In addition to the indoor thermal performance green roofs also provide cyclone resistance, aesthetics and higher robustness to the building.

Keywords: green roofs, indoor thermal performance, warm humid climate, rapid Urbanization, traditional roofs

ID: 97

Post conflict housing reconstruction: housing needs and expectations of conflict affected communities

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Post conflict housing reconstruction plays an important role in establishing the country's development and prospect of peace. Despite this importance, it was identified that there are inconsistencies between the provision of built housing and the needs of the users. Therefore many post conflict housing reconstruction projects lead to dissatisfaction on the part of residents and remodelling by themselves or rejection and abandonment. Hence it is important and necessary to address conflict affected communities' housing reconstruction needs in post conflict housing reconstruction. With regard to this, it is worthwhile to examine the concept of housing needs in general and to explore the housing needs of conflict affected communities. Therefore this paper aims to present a synthesis of housing needs literature relevant to usual and post conflict contexts. In relevance to housing needs in general, housing preferences in a market context and adequate housing measures were identified. Following this, housing needs of conflict affected communities were identified. In a market context, housing needs were exhibited in terms of the subjective preferences of households. Adequate housing was recognized as part of the right to an adequate standard of living in the 1948 Universal Declaration of Human Rights and in the 1966 International Covenant on Economic, Social and Cultural Rights. Hence adequate housing measures identified certain aspects of housing that must be taken into account for this purpose in any particular context. Whilst most housing considerations of conflict affected communities were similar to adequate housing measures, conflict affected communities gave greater importance to their social, cultural and religious values in post conflict housing reconstruction. In addition they considered the aspects of safety and security as being vital, and various perceptions of these communities in relation to housing reconstruction and post occupancy evaluation were important in post conflict housing reconstruction. Nevertheless, no relevant data on special housing needs of disadvantaged groups in post conflict environments were found.

Keywords: post conflict housing reconstruction, housing needs, housing preferences, adequate housing, housing considerations of conflict affected people

ID: 103

Disaster knowledge factors: benefits and challenges

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Disasters bring about the loss of lives, property, employment and damage to the physical infrastructure and the environment. The number of reported disasters has increased steadily over the past century and risen very sharply during the past decade. While knowledge management can enhance the process of disaster management, there is a perceived gap in information coordination and sharing within the context of disaster management. Identification of key disaster knowledge factors will be an enabler to manage disasters successfully. This study aims to identify and map key disaster knowledge success factors in managing disasters successfully through capturing good practices and lessons learned. A list of disaster knowledge factors was first identified through a comprehensive literature review, covering the whole disaster management cycle. Based on these literature findings, semi-structured interviews were conducted among few disaster management practitioners to explore the influence and lacking areas relating to these factors in managing disasters. The objective of this paper is to present the interview findings on benefits and challenges related to the disaster knowledge factors. A comprehensive list of benefits and challenges of disaster knowledge factors in managing disasters is identified.

Keywords: disaster management, disaster knowledge management, disaster knowledge factors, benefits, challenges

ID: 104

Build back better – implementation in Victorian bushfire reconstruction

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The term “Build Back Better” (BBB) is becoming a prominent term used in the post-disaster reconstruction environment. It signifies reconstruction as an opportunity to improve a community’s pre-disaster situation to increase its resilience to future disasters while also working on its social and economic recovery. This paper looks at various elements which have been identified to be implemented and coordinated to achieve BBB success. These concepts include: Improvement of Structural Designs, Legislation and Contract Facilitation, Land-Use Planning, Town Planning, Transitional Accommodation, Community Consultation, Stakeholder Involvement, Resources, Economic Recovery and Pre-Planned Processes and Frameworks. The Victorian Bushfires was selected as a pilot case study to examine how these concepts were incorporated in reconstruction and their outcomes. The information was obtained from conducting semi-structured open-ended interviews with professionals from a range of important stakeholders from national and local authorities to builders directly involved in the recovery process. Finally these concepts are examined in further detail identifying successful initiatives which should be adopted as well as any shortcomings that were apparent with suggested improvements.

Keywords: build back better, post-disaster reconstruction, Victorian bushfires

ID: 105

Flood vulnerability and hazard adjustment of UK commercial sector: a synthesis of research

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The increasing damage to commercial properties caused by rising number of floods in the UK has emerged as a complex conundrum to the economy. Total tangible losses in the commercial sector have been enormous and they are often uninsured. Properties characterized by large assets, significant capital investment, operational and maintenance costs are further challenged by lack of awareness among property owners and occupiers, government investment policies to flood risk reduction and predictions of increasing number of floods due to changes in climatic conditions. There is a serious need for understanding the working of different sectors within the commercial property framework to gain knowledge of the reasons behind the oversight in damage control and their level of vulnerability. A review of the aspects of direct and indirect vulnerability is presented followed by preparation, response and recovery measures for commercial properties to identify key factors which contribute to loss reduction. These concepts were examined through an exploration of the existing literature on flood damage including scientific literature, government reports, statements from commercial property stake-holders and documents from insurance companies. The research adopts an approach of strategic and critical evaluation of literature to grasp the fundamentals of the current state of knowledge. Outputs from the study highlight that a large proportion of loss from flood events are due to lack of preparedness. The theoretical integration of the research helped in generation of a conceptual framework of vulnerability related to capital, labor, suppliers and consumers within the sector. Moreover, it aided in synthesizing the basis of hazard reduction framework to reduce vulnerabilities. The research concludes that cost of flood damage to the commercial properties can be significantly reduced if preparation efficiency within the sector is made stronger by implementation of risk reduction measures in the form of hazard adjustment plan. Implications from the study suggest that research can play a key role in helping to develop an understanding of appropriate flood risk reduction strategies and towards raising awareness among stakeholders.

Keywords: flood-damage, vulnerability, preparation, response, recovery

ID: 107

Post-disaster housing reconstruction: challenges for community participation

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The extant literature suggests that community participation is an important ingredient for the successful delivery of post-disaster housing reconstruction projects. Even though policy-makers, international funding bodies and non-governmental organisations broadly appreciate the value of community participation, post-disaster reconstruction practices systematically fail to follow, or align with, existing policy statements. Research into past experiences has led many authors to argue that post-disaster reconstruction is the least successful physically visible arena of international cooperation. Why is the principle of community participation not evident in the veracity of reconstructions already carried out on the ground? This paper discusses and develops the concepts of, and challenges to, community participation and the subsequent negative and positive effects on post-disaster reconstruction projects outcomes.

Keywords: post-disaster housing reconstruction, community participation, challenges

ID: 108

The impact of green roofs on urban heat island effect

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Growth of the world urbanization has been extensively accelerated since past few decades. With the increasing urbanization, the land with permeable layers and moist have been altered. As a result, urban heat island phenomenon has taken place, making the temperature in the cities to be higher than the country sides. Heat island effect in cities is mainly because of non natural heat absorbing materials use in buildings and other manmade structures. Natural greenery in the cities was replaced by concrete yards and most of the cities urbanizing with more and more concrete. Since there is no space to grow, adding greenery to cities is also an issue. Having greenery over the roof or planting on roofs are now becoming popular in many countries. Green roofs play a major role as a sustainable solution to minimize the heat island effect. This paper discusses about the effects on the surrounding temperatures, if the existing flat roofs in the Colombo city, the capital of Sri Lanka, are replaced with green roofs. The reduction in the temperature in the atmosphere was calculated using actual measurements on small scale models and computer simulation. These findings were coupled with the energy balance of the city. From the results obtained, it can be clearly shown that there's a significant reduction in the temperatures, in the city when compared to the prevailing condition. The forecasted condition proves that the foreseeable problem of urban heat island effect with the future developments can be drastically reduced with the introduction of green roofs.

Keywords: heat island effect, green roofs, sensible heat, energy balance, computer simulation

ID: 113

Effect of different ventilation conditions on indoor CO₂ levels

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This paper describes a study on (Carbon Dioxide) CO₂ levels based on different ventilation systems. Three main types of buildings were considered in the study, such as educational, office buildings and hospitals. The effect of different systems of natural ventilation systems on CO₂ levels was studied. The measurements were taken by accommodating different situations in the open able condition of windows: fully opened, half opened and fully closed. It was found that, the size of windows, the number of windows and the positioning of windows have major impact on indoor air quality. CO₂ measurements were taken in both naturally ventilated buildings and mechanically ventilated buildings. And a comparison was made between mechanically and naturally ventilated systems. In mechanically ventilated buildings two types of air conditioning systems namely cold water air conditioning system and spit type air conditioning system were considered for the comparison. Cold water air conditioning system was found to be good than the split type air conditioning system under improper maintenance conditions. From the experimental measurements we can conclude that the CO₂ levels are higher in mechanically ventilated buildings which are not properly operated than in naturally ventilated buildings.

Keywords: indoor air quality, artificial ventilation, natural ventilation, different air conditioners, different types of buildings

ID: 114

Construction procurement selection: comparative study of routine projects vs. disaster reconstruction projects

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Construction procurement methods practiced in the industry have been subjected to changes resulting in many newly developed systems that could be used to meet contemporary requirements of the clients. Selection of a wrong procurement method usually leads to project failure or client's dissatisfaction. Therefore, a systematic approach for selection of the most appropriate procurement method is essential to aid clients in achieving their ultimate project goals. The procurement needs of the Routine projects are different from that of Disaster Reconstruction projects due to the inherent differences between the two types of projects. However, previous research dealing with procurement selection has not taken this difference into consideration. The aim of this research was to test whether there is a significant difference between procurement selection parameters of Routine and Disaster Reconstruction projects. This paper presents the prioritized procurement selection parameters for Routine and Disaster Reconstruction projects with the use of Analytic Hierarchy Process. A Questionnaire Survey was administered to obtain the data to implement the Analytic Hierarchy Process. The results revealed that the factors for Routine projects and Disaster Reconstruction projects are different for some few factors.

Keywords: construction industry, procurement selection, routine projects, disaster reconstruction projects, Sri Lanka

ID: 118

Numerical approach to study the effect of bond between masonry and concrete for cracking in masonry walls due to thermal movements of overlying slab

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Numerical approach to study the effect of bond between masonry and concrete for cracking in masonry walls due to thermal movements of an overlying slab Concrete slabs exposed to direct sunlight experience thermal movements. These movements can result in over stressing and cracking in underlying masonry walls. Even though these cracks are non structural, they lead to considerable problems with respect to the performance and appearance of a building. The issue may become severe by the effects of global warming, which is likely to increase the global surface temperature further by 1.1 to 6.4 °C during the 21st century. This paper explores the development of cracks in masonry walls due to the time varying thermal load on an overlying slab through a non-linear structural-thermal coupled analysis. In this study typical structural arrangements were mathematically modelled to investigate the effect of the bond between concrete and masonry for developing stresses in masonry and consequent cracking. In addition, the effect of modelling masonry as an anisotropic material rather than an isotropic material was investigated. Keywords: thermal movements, numerical modelling of masonry, anisotropic material, non-linear structural-thermal coupled analysis, cracking in masonry

Keywords: thermal movements, numerical modeling of masonry, anisotropic material, non-linear structural-thermal coupled analysis, cracking in masonry

ID: 121

Social vulnerability and disaster risk reduction needs: perspectives of women

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Integration of disaster risk reduction needs and experiences of different groups in the community with the built environment is significant to achieve disaster resilience. It facilitates identifying the nature of disaster vulnerabilities within a particular community leading to achieve disaster risk reduction more effectively. Women's needs and experiences are prominent in this context since women have been identified as a highly vulnerable group to disasters. Women's higher disaster vulnerability is typically determined by their social roles and responsibilities. Their responsibilities over production and reproduction frequently expose them to different conditions in disasters with varying vulnerabilities. This paper is based on a doctoral research that aims to investigate how women's knowledge, experiences and needs and concerns in relation to disaster risk reduction can be identified and integrated with disaster risk reduction in the built environment. A comprehensive literature review has been carried out in order to explore various aspects of social vulnerability, disaster implications on women, women's needs in disaster risk reduction and the means of needs capturing and integration. Participatory methods such as public consultations are suggested as the most effective ways of capturing disaster risk reduction needs of community women in literature whilst the significant role of construction process and people involved in it is highlighted for integrating the needs with the built environment.

Keywords: built environment, disaster risk reduction, social vulnerability, women's needs

ID: 126

Push and pull factors of environmental resettlement in Sanjiangyuan area in China and the effects on the migrants

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Sanjiangyuan Area is located in Qinghai Province in Western China. In last several decades, Sanjiangyuan area are facing serious ecological crisis due to the interactivity of natural factors and human factors, such as glacier and permafrost zone retreating, grassland deteriorating and desertification, water and soil loss, biological diversity damaged, etc. Due to the critical situation of the environmental degradation, Chinese government started to build the Sangjiangyuan Reserve Area to protect the environment of Sangjiangyuan area. As part of the planning, environmental migration project started in 2004. The aim of the project is to decrease the population pressure on this area and also to increase the living standard and economic ability of the people who will be displaced from this area. By May 2009, 86 resettle villages have been built and more than 10 thousand households and nearly 50 thousand people have migrated into the new villages or communities. Environment induced resettlement in Sangjiangyuan area has drawn a lot of attention in China. Based on the survey data and focus group discussion record with government officials, migration village cadres and migrants in 5 counties in Sangjiangyuan area which conducted in July 2009, this paper used the push-pull model to analyze the push and pull factors in origin and destination, the intervening obstacles and the personal factors of the migrants. It also wants to analyze the effects of the resettlement on the migrants. It shows that government policy is the driven factor for the migration, the pull factor of origin is relative weak and the most attractive factor in destination is the better education condition. Several policy applications also were discussed in the paper.

Keywords: push-pull factors, environmental migration, migrants, Sanjiangyuan area, China

ID: 134

The attributes of resilience: a tool in the evaluation and design of earthquake-prone cities

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Theories of recovery planning and urban design theories have a common interest in providing for the health and safety of urban communities. However the requirements of safe refuge and recovery after a disturbance, such as an earthquake, are sometimes at odds with theories of urbanism. This paper proposes the concept of resilience as a way of aligning these disciplines. The paper analyses the data from two case studies: the earthquake and fire of 1906 in San Francisco, and the Chile earthquake of 2010. It uses a set of resilience attributes already embedded in the discourse of urban theory to evaluate each city's built environment and the way people have adapted to that built environment to recover following an earthquake. The findings suggests that that resilience attributes, when considered interdependently, can potentially assist in the design of resilient cities which have an enhanced capacity to recover following an earthquake. They also suggest that the key to the successful integration of recovery planning and urban design lies in a shift of thinking that sees resilience as a framework for the design of cities that not only contribute significantly to the quality of everyday urban life, but also can be adapted as essential life support and an agent of recovery in the event of an earthquake.

Keywords: resilience, recovery, earthquakes, urban design, adaptation

ID: 137

Crisis in rebuilding resilience in rural Asia

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Culturally and environmentally unsuitable and unsustainable development does not build resilience amongst displaced communities, it serves only to create a false and temporary sense of social elevation, urbanisation and security—a situation that is potentially dangerous and could contribute to new disasters and a future crisis.

This paper presents the findings of a study that investigated the appropriateness of post-disaster resettlement housing in Sri Lanka and South Asia to the local culture and context.

Low cost resettlements built after disaster in rural regions of the developing world share many similarities. While they are adaptations of housing for nuclear families, and widely perceived as economical and suited to local 'standards', they have time and again failed to respond to the contextual needs of rural poor communities. Resettlement housing is often seen by governments as an opportunity to elevate poor communities to standards considered appropriate by the 'western(ised)' world. Such a developmental drive has introduced to rural environments a certain 'newness'. While 'newness' has the potential to enrich tradition it can also disrupt intricate social relationships, contribute to the cultural and economic breakdown of communities and increase vulnerability. This study highlights the socio-cultural significance and impact of this 'newness' on the rural poor. The paper takes the position that the primary characteristics of a generic post-disaster house and many of its elements due to their inappropriateness to rural situations, culturally and environmentally, is mere 'decoration'—the outcome of insensitive top-down approaches to reconstruction and a lack of appreciation, understanding and knowledge of local traditions, resources and environments. Similar findings from Thailand, Indonesia and India locate this crisis as a regional problem affecting the resilience of South Asia's rural communities after disaster.

Fundamental to building resilient communities after disaster is a reconstruction endeavour that satisfies sustainability in the three principal aspects of socio-culture, eco-environment and economics. This paper demonstrates the significance of community led and directed reconstruction endeavours for rural environments. It highlights the urgent need for change in attitudes and approaches to reconstruction after disaster, particularly if building sustainable and resilient communities is the aim of such undertakings.

Keywords: resettlement housing, community, tradition, rural environments, disaster

ID: 139

Evaluation of ambiguity effect of earthquake retrofit on willingness to pay

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Earthquake retrofit is one of the most important measures for mitigating economic loss and saving residents' lives from earthquakes. The Japanese government initiated the policy that 90% of houses must become earthquake-resistant and has provided various supports for earthquake retrofit such as financial aid to homeowners and free checking for earthquake resistance. However, earthquake retrofits are not as widespread as expected. Home owners hesitate to carry out earthquake retrofit for several reasons, including budget or time constraints, confidence in the house's strength, low perceived earthquake risk, and ambiguity of earthquake retrofit effectiveness. This study focuses on the last reason. In our survey, 23% of respondents state ambiguity as the reason for not implementing earthquake retrofit. Many homeowners experience ambiguity about earthquake retrofit effectiveness because they do not understand it well. Ambiguity causes many people to become pessimistic. Ambiguity aversion was originally identified by Ellsberg (1961) and has been confirmed through many empirical analyses. In this study, we evaluate how ambiguity about earthquake retrofit effectiveness decreases homeowners' willingness to pay. For this purpose, we conducted a web-based questionnaire survey with 1200 homeowners in late March 2009. The questionnaires asked their perceived risk of earthquake and subjective probability of destruction of their houses in an earthquake. Then, two types of earthquake retrofit plans were presented to them; a standard earthquake retrofit plan and an earthquake retrofit plan with warranty that their houses would be repaired for free of charge if destroyed after earthquake retrofit was performed. The latter plan eliminates any ambiguity of effectiveness. Six hundred respondents were asked their willingness to pay for the former plan, and the remaining 600 were asked their willingness to pay for the latter plan. The survey revealed that willingness to pay for the earthquake retrofit plan with warranty was much greater than for the standard plan, suggesting that ambiguity about earthquake retrofit effectiveness reduces its value.

Keywords: earthquake retrofit, ambiguity, warranty, economic value

ID: 142

Is Trincomalee District reawakening? Post-conflict reconstruction and economic revival

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The Trincomalee district on the eastern coast of Sri Lanka had been affected by both the 30 year prolonged 'ethnic conflict', and by the Indian Ocean 'Tsunami' of December 2004. The district is multi-ethnic in composition with Muslims (42%), Tamils (32%) and Sinhalese (26%), and majority of them are employed in agriculture (58%) and fisheries (30%). The Government of Sri Lanka along with help from international donor agencies had implemented various post-conflict development works. This paper presents an analysis of post-conflict development programs for reconstruction and revival of economic and livelihood activities in the district. During the period 2006-2010, much of the investment was on infrastructure (roads, drainage and bridges) development (65.96%), with a marginal amount being on livelihood development and revival activities (5.24%). Fish production in the district had significantly increased from 8,150MTons in 2007 to 26,405MTons in 2009. About 21,018 families depend on fishing for their livelihood, but the level of investments to support this sector had been very marginal, only Rs.242Mn. spent for the rehabilitation of the Cod Bay fishery harbor and Rs.100Mn, for construction of a new fish market. Irrigation is vital for agricultural activities in the district, but it was observed that of the total Rs.797Mn. allocated for rehabilitation of the major irrigation schemes, only Rs.475Mn.(59.59%) had been spent by 2009. While investments in social development, were in water supply, electricity and common amenities construction. In relation to pipe water supply for DS areas of T & G, Kinniya, Thambalagamam, and Nilaweli, only about 58.58% of the needed pipe connections had been provided. Similarly in housing reconstruction for conflict and tsunami affected/damaged houses, out of 48,506 damaged houses only 38.01% had been renovated or newly built. Industrial development has also been very slow, focusing on salt production with an investment of Rs.500 Mn., and providing employment to about 800 persons. Post-conflict reconstruction should not primarily focus on infrastructure development, but also pay equal attention to revival of livelihood activities of the people so that continued dependence on external agencies help could be avoided or minimized. This not only assists in resilience of economic activities, but also increases the incomes of families affected.

Keywords: post-conflict, infrastructure, reawakening, reconstruction, economic revival

ID: 143

Do minor tanks have an impact in revival of agriculture in post-conflict scenario? Evidence from minor tank rehabilitation in Mannar District, Sri Lanka

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The Mannar district on the northern coast of Sri Lanka had been severely affected by the 30 year prolonged 'ethnic conflict'. It is situated in the North-Western part of Sri Lanka. The district is multi-ethnic in composition with Tamils (51.3%), Muslims (26.1%), and Sinhalese (8.2%) and majority of them are employed in agriculture (61%) and fisheries (25%). The Government of Sri Lanka along with help from many donor agencies had implemented various post-conflict minor tank reconstruction works. This paper presents an analysis of minor tank rehabilitation programs for the revival of agricultural activities in the district since the end of the 'conflict/war'. This study is based on secondary data collected from the Dept. of Agrarian Services and publications. There are 348 minor tanks available which irrigate about 14,975 acres of paddy lands every year. Most of these minor tanks are located in the Madhu (105), Nanaattan (59) and Manthai West (141) DS areas. But due to the recent replacement of the people many of the Minor tanks have been abandoned and covered with heavy jungles. Only 96 minor tanks have been rehabilitated till now (27.59%). In 2009 and 2010 only 32 minor tanks were rehabilitated with an investment of Rs.82Mn. Due to the rehabilitation of minor tanks many of the resettled farmers are expected to be benefited and their living standards also be uplifted. Data revealed that the rehabilitation of the Rakkikulam, Thethavadimaruthamadu, Adiachikulam-II, Kokkumadhu, Periyayavannarkulam minor tanks, at a cost of Rs.8.8Mn. had increased the land cultivated with paddy from 120 acres to 352 acres. The net increase of 232 acres of new paddy lands irrigated had increased the income of farmers by Rs.12.04Mn., a substantial economical impact due to the renovation of the above minor tanks during the last Maha Cultivation (2009/10). Hence it is clearly evident that investment in irrigation infrastructure, such as rehabilitation of tanks abandoned, can have a significant impact on revival of agriculture and raise income of farm families affected. Thus post-conflict reconstruction should be directed to activities that can have quick impact on those affected, especially through reviving their livelihoods.

Keywords: post-conflict, minor tanks, rehabilitation, agriculture, economic revival

ID: 144

Decision support system to handle logistics and supply chains related to disaster management

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Efficient operations of logistics are paramount requirement in a disaster affected situations since many lives are in life and death situations solely depends on it. In order to have efficient logistic operations in disaster hit situation, many decisions have to be taken with real time or latest information. Taking many decisions based on real time or latest information is not a simple task due to the time factor to save lives. Sri Lanka is vulnerable to numbers of natural disasters, more frequently floods and earth slips in some parts of the country. Logistics mainly supports two ways in disaster hit places by: rescuing them or providing essentials to survived victims. However, awareness about disasters and how to react in disastrous situations is very poor among the public as well as the governmental organizations. Due to these issues necessary and essential warnings with how and where to move, time lines etc. will not pass into public on time. In addition, due to lack of coordination of logistics activities, certain part of affected people get more food and some even will not receive any. The problem addressed here deals with the flood disasters and how evacuation process take place systematically in order to move the vulnerable people into more safety places. The system developed in this study determines the best place to move the affected people at that particular area by following the most safety and the closest route. The safety path and mode of transportation is determined according to weighted value which is determined by the Decision Support System based on the current status of ground conditions and geographical information previously fed to the DSS. The weighted value is calculated online by considering the possibility of blocking the road with the amount of rainfall in the catchment areas. It is very rare to find studies which consider above objectives simultaneously where it is developed as multi objective model here and also hybrid algorithm (combination of Tabu Search and Simulated Annealing) and Dijkstra algorithm is used to find optimal paths. Moreover, online decision system according to parameters of weather condition is new and important to this field. Therefore, the developed system is capable of finding an alternative cost effective paths and mode of shipping effectively.

Keywords: logistics in disaster management, decision support system, multi objective optimisation, shortest path search

ID: 146

Basic methodology for landslides related to disaster preparedness in Sri Lanka

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Recent disasters in the world show us importunity of level preparedness and what we can save from being prepared beforehand. Disaster preparedness also becomes essential part of our life since frequency of disaster occurrences have increase considerably in last couple of years. It is widely accepted that the main reason for unexpected weather patterns are caused by the climate change due to the green house effect faced by the earth. Due to sudden changes in the climate, there will be storms with high magnitude to a large region within a very short period of time thereby creating havoc situations leading to floods in the lower catchment areas and lands slides in the hilly areas. Conversely, due to rapid growth of population especially in South Asian region, the land usage has been increased many folds and suitable and safe lands for sheltering are diminishing rapidly. Hence, majority of poor people tends to live in places in steep slopes which lead to landslides in hilly areas and lower marshy lands which are subjected to flooding very often. Though there is a separate ministry and different organizations to handle disasters in Sri Lanka, still it can be seen that large number of people suffers from natural disasters and fair number of them even losing their lives. This may be mainly due to lack of knowledge on disasters and carelessness of the majority of them. Therefore this research focuses to find the level of awareness of probable disasters and their disaster preparedness in selected sample of people in central highlands of Sri Lanka. Through this study it is expected to develop low cost indicators to highlight the possibility of disasters in these areas and to empower them for disaster preparedness through non-formal education methods. Awareness was checked by conducting a survey in different parts of central highlands of Sri Lanka. The empowerment is being achieved through non formal education methods for the elders. These are simple methods which will guide anybody to recognize the changes and to act on them. The initial stages of the project showed positive results and majority of the stakeholders have shown enthusiasm towards the programmes conducted under this research.

Keywords: disaster preparedness, landslides, non-formal education, landslide indicators, empowerment

ID: 147

Sustainable construction: an information modelling approach for waste reduction

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Construction waste is considered as a major contributor of solid wastes in municipal landfills. Construction, renovation, and demolition (CRD) waste generated by the Canadian construction industry accounts for 27% of total municipal solid waste disposed in landfills. However, many researchers stated that 75% of what the construction industry generates as waste has a residual value and therefore recycled, salvaged, and/or reused. With the same philosophy, municipal landfill facility of the city of Vancouver and Kelowna, Canada restricted the acceptance of construction waste. In such circumstances construction waste has to go for recycling, which is as costly as to go for new material. Sustainable and practical solutions then have to: 1) maximize the reuse of construction waste during the project construction phase, and 2) optimize the material usage of the 'proposed construction' in the design phase itself. To achieve both of these objectives, real-time information system - that can forecast potential waste of given project/s with material properties, cost, time, life cycle, and manufacturer specifications - is required. Building Information Modeling (BIM) is a relatively new and much unexplored area in construction waste management, which has immense potential with today's computing power and technology. BIM can be used to optimize construction material use (and reuse) by micro-mapping construction lifecycle with virtual resource management. An optimized building model can be obtained by simulating the objects and spaces in the BIM with a novel use of dynamics modeling techniques and multi-criteria decision making methods. In addition, the proposed system dynamics modeling approach allows real time optimization of material discrepancies due to changes in the scope of construction projects. BIM as a virtual construction tool, integrated with project scheduling tool and proposed simulation technique, will facilitate waste minimization, right at the source, and allows construction managers to pre-plan sustainable construction by reusing waste material throughout the project lifecycle.

Keywords: sustainability, construction waste management, building information modelling, system dynamic modelling, waste prediction and reuse

ID: 148

Assessing the benefits to community vulnerability of proactive adaptations for disaster risk management

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While the need to move beyond reactive adaptations for disaster risk management is well established, the benefits of a more integrative, proactive framework need to be assessed in terms of community vulnerability. Dynamic system modelling is a valuable tool for integrating concepts of vulnerability, resilience and adaptation and understanding the relationships among them for the purpose of reducing future vulnerability level. We undertook a case study in Centini village in East Java Province, which is one of the poorest villages in Indonesia and is exposed to both an annual flood and an occasional much larger flood. In building the dynamic system model, we parameterise vulnerability in terms of a range of indicators and factors. The indicators include number of victims, damage losses and time to recovery. Twenty-nine factors that influence community vulnerability to flood were selected using a Delphi method. We developed two main scenarios of adaptations based on 1) current adaptations, which are predominantly reactive and 2) integrated adaptations, which include proactive measures such as spatial plan implementation, economic development program and proactive community actions. We conducted telephone interviews with key stakeholders to determine their perspectives on the interactions among indicators, factors and adaptations. The interviews also reveal other key variables in understanding the dynamic and systemic relationship among indicators, factors and adaptations. Based on the interviews, we developed seven sub models of community vulnerability that are: sub model of flood, victims, housing, responses, income, expenditure and savings. The seven sub models are interlinked in order to appraise current and future vulnerability levels based on the scenarios of adaptations. The model results highlight the benefits of integrating the concepts of vulnerability, resilience and adaptation in explaining how the impacts of hazards can be minimised. The model can be used to assess the benefits to community vulnerability of proactive adaptations for disaster risk management.

Keywords: community vulnerability, dynamic modelling, flood, resilience, adaptation

ID: 151

Early detection of wild elephants to prevent train-elephant accidents

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In the last couple of years wild elephant killings due to train accidents numbered as 15-20 elephants annually. Nevertheless, these accidents mainly kill elephants, sometimes they may be disastrous too due to the damage caused to the track and sometimes minor injuries to passengers also due to sudden stoppages. These occur in several stretches of the railway tracks in Northern and Eastern lines which are falls through wildlife sanctuaries such as Somawathiya, Minneriya, Flood plains and some elephant corridors. There are some similarities in these accidents. Most of the time mothers and calves are meeting with accident as groups, happens during the nights during rainy and flooding seasons. Though these types of accidents occur over the past decade, up to now, only ad hoc solutions have been taken and even they are not fully functional due to many difficulties. Currently, some speed limits and warning sign boards are placed in these stretches in addition from time to time wild life departments officials used to travel with locomotives during the night trips to help locomotive operators to recognize elephants if available on tracks. Until now, no proper study has been carried out on this problem. Therefore, this research tries to identify inherent problems related these accidents and to come up with sustainable solution with the help of modern communication and scanning technology without much investments. Basically two directional technical approaches have been experimenting in this regards. One approach looks into use low frequency communication signals to repeal elephants from the track when trains are plying in these stretches and in other option, long range Infra-red cameras to be used along with real time image processing device to detect whether elephants are on tracks within stoppable distances. Currently both approaches are being tested in experimental basis and both show positive results though both have some inherent limitations. Therefore it can be concluded that by adapting suggested technical approaches, disasters due to these types of accidents can be prevented.

Keywords: disaster detection, disaster prevention, sustainable solution, low frequency communication signals, infra-red senses

ID: 152

Is disaster education just knowledge transfer?

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In Japan, disaster education is considered as a useful thing for reducing damages from disasters. Japanese disaster education is sometimes exported to the disaster-prone countries in order to improve their coping capacity with disasters. However, it is not guaranteed that the exported disaster education contributes to reduce damage from disasters. There is an enormous difference between Japan and the developing countries in terms of standards of hardware such as building standards. As the reflection of this difference, if an earthquake hits a developing country, residents in the country have to bear with catastrophe caused by the earthquake. However, it is either not guaranteed that Japanese disaster education contributes to reduce damage of Japanese society. Needs of disaster education in Japan have risen after 1995 Kobe earthquake. It was learned from the Kobe earthquake that if most ordinary people do not prepare for disasters, there would be a high possibility of occurrence of a catastrophic disaster even if there is a high level of building standards. There has been a tacit understanding that disaster management is done by so-called experts in Japan for a long time. After the Kobe earthquake, there has been an argument that in order to prepare for disasters by ordinary people, education should be provided for them. Meanwhile, there have been many evidences that the disaster education has not contributed to prepare for disasters. For example, people understand the danger of furniture during tremor of earthquake and know how to make furniture tip-resistant. However, only 26.2% of people have done furniture fixation. This situation is results from the narrow definition of disaster education that is "knowledge transfer of disaster management". What is disaster education? Learning something means someone become to be able to do something new. Disaster education must become an activity that someone becomes to be able to prepare for disasters. In this paper, in addition to discussion of the theoretical work for the new disaster education, a case study of the new disaster education in Nepal which is exported from Japan to a developing country and orients to avoid repeating the above mentioned issues is also introduced.

Keywords: disaster education, communities of practice, legitimate peripheral participation, disaster reduction volunteers for debris flows

ID: 154

Risk identification on community based post disaster housing reconstruction projects

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In recent years, millions of houses have been damaged or destroyed by natural disasters, such as from earthquake and tsunamis. These disaster situations have led to the construction of a large number of housing units for disaster affected communities. Community based method in which beneficiaries participate with powers to control reconstruction projects has proven that high satisfaction can be achieved among survivors with high accountability and producing good quality houses. However, this method has its own problems also having been exposed to high risks. In construction industry, risk management process has been acknowledged to be an important factor to achieve project objectives. In contrast, examples demonstrating good practices of the application in post disaster reconstruction project are very limited. A typical risk management process is started with risk identification, and in this context this paper aims to identify risk associated with the community based post disaster housing reconstruction process. Special emphasis will be given to the “pre-construction stage” of the process. Comprehensive literature review and interviews were conducted to achieve the objectives. Interviews were conducted with experts, practitioners, government official and representatives of affected communities in Indonesia. It was found that risks associated with community based post disaster housing reconstruction project at the pre-construction phase is higher than that of during the construction phase. It derives from the situation that in this method the pre construction stage plays a very important role of the whole reconstruction process and also because of many uncertainties exist at this stage. Some key risks that are found which are associated with this include: this method is not very well understood by many stakeholders, especially by local government and poor coordination between stakeholders and their roles in housing reconstruction. Since this method requires facilitation, the unavailability of them, both in terms of numbers and experience can affect the levels of success of the community based method. In this context, building a trust from community to facilitators is also imperative.

Keywords: community based, housing reconstruction, risk identification

ID: 157

Agile supply chains as disaster resilience strategy: a theoretical review

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Resilience is a critical facet for effective disaster recovery that could potentially ease the lasting impact that disasters leave on individuals, communities, and economies of impacted regions. It is not possible for governments to precisely predict the scale and nature of the events they will have to manage, however, states and communities can develop resilience to cope with disaster and subsequent reconstruction process. It is argued that supply chain contextualisation can assist in analysing post disaster reconstruction environment and process, from the construction industry perspective, to understand the complex interplay of number of variables impacting reconstruction. Understanding of issues associated post disaster reconstruction supply chain can lead to improved resilience. Identifying weak connections between supply chain organisations while improving the agility of supply chains can assist in resilience enhancement. This paper proposes four key aspects dominating post disaster supply chain design and operation namely: political, economical, legal and cultural environment, density of proposed infrastructure typology, stakeholders of the reconstruction process and context specific issues arising from the previous three aspects. It is suggested that resilience can be achieved through creating agility in the legislative process, labour/skill supply sector and material/resource supply sector.

Keywords: disaster reconstruction, disaster resilience, construction supply chain

ID: 159

Development of learning tools for flood risk communication

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Engineering works for flood disaster reduction have progressed, but flooding still continues to pose a major challenge to us. In Japan, frequent destructive rainstorms probably due to the global warming have caused severe flood damages in recent years. Then, plans have been discussed for more effectively reducing flood damages, incorporating both hard and soft approaches. In these plans, flood disasters are considered not to be physical process, but rather socio-economic issues. It is important to put such plans into practice with the division of roles and the cooperation of self-, mutual-, and public-help. Indeed, there has been a significant move from strategy of the flood defence to one of flood risk management. It is widely recognized that community-based flood risk communication among residents, regional communities, and administrative authorities is central to effective flood risk management. A flood simulation and an evacuation simulation are useful tools for managing the flood risk communication because the simulations help the stakeholders understand the flood risk. We developed a flood simulator and an evacuation simulator for the flood risk communication. The flood simulator is based on shallow wave equation of two dimensions and flooding is analyzed by finite difference method. The evacuation simulator is based on multi-agent model and reflects the result of the flood simulation. However, it is not easy to arrange the data, such as GIS map, river, road, population, and elevation in the target area, for the both simulators. Since each time the target area of the risk communication changes the simulations have to be made, it is a heavy load for a simulation operator to increase the target areas. Human resources who can make the simulation are also limited. Then, it is difficult to easily spread the flood risk communication with the simulation. In this study, the platforms of the developed flood and evacuation simulators are integrated and the operational functions of the simulators are improved. These development and improvement help us to execute the simulations and make the spread of the flood risk communication with the simulation possible.

Keywords: flood simulation, evacuation simulation, risk communication, risk management, disaster mitigation

ID: 161

Tsunami damaged buildings assessment using high resolution satellite imagery, GIS & GPS data

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This paper presents a methodology and results of evaluating damaged building extraction using an object recognition task based on Differential Morphological Profile (DMP) for Very High Resolution (VHR) remotely sensed images. The proposed approach involves several advanced morphological operators among which an adaptive transforms with varying size, shape and gray level of the structuring elements. IKONOS-2 Satellite images consisting of pre and post 2004 Indian Ocean Tsunami site of Kalmunai area in east coast of Sri Lanka were used. Morphological operation of opening and closing by constructions using structural element are applied for segmented images, then derivative of the opening profile is defined as the vector. ISODATA algorithm is used for the feature extraction and the results comparison with ground truth data. This result appeared to have high accuracy, the confidence measures produced of completely destroyed structure gives 60% and 86% by object base and pixel base respectively after the tsunami in one segment of Maruthamunai GN Division.

Keywords: remote sensing, GIS, GPS, high resolution satellite data, Tsunami

ID: 163

Gender aspects of dairying in Eastern Province, Sri Lanka

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Gender is going to play an important role in all future development plans. This will be true in the dairy industry of the country also. Therefore this study examines the nature of gender in dairying of the Eastern Province Sri Lanka. This study was conducted in Eastern Province where dairy owned households were resettled. Gender in dairying reflects the attribute of dairy ownership by sex. The female dairy ownership was 5.40 percent out of whole sample. 17.64 percent of them carried out dairying as primary occupation. 29.4 percent of them were members in any dairy related organization. Female dairy owners were adopted to free range and semi-intensive systems of rearing. 23.53 percent of them followed semi-intensive system. The mean traditional, cross and buffalo herd size of them were 6.8, 8.3 and 5 respectively. These figures were as 10.5, 8.3 and 26.3 for male dairy owners. 35.30 percent of female dairy owners were hold only cross breeds. 17.64 percent of female dairy owners were had closed sheds. Peak cross breed's mean milk production in female and male dairy owner's households were 4.60 and 3.91 liter/animal/day. Female dairy owners also involved with different marketing outlets to sell their milk. 23.53 percent of them sold to milk cooperatives and another 23.53 percent of them sold to traders. Mean milk price to traders were as 27.50 and 29.53 Rs/Liter for female and male dairy owners respectively. Only 11.76 percent of female dairy owners were hired labour for looking after the animals. The mean costs of production were as 492.79 and 351.72 Rs/animal/month between female and male dairy owners. The mean profits were calculated as 111.04 and 223.74 Rs/animal/month between them. Most of the time dairy income was received by females (57.6 percent) among the sampled households. Female dairy owners were faced several problems in dairying. It was naked that gender should be considered and given equal participation through the extension and development of dairy industry.

Keywords: dairying, gender, Eastern Province, ownership, resettled

ID: 165

Application of passive solar building design technique in apparel buildings

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The green building concept has been successfully adopted by many countries in their construction to save energy, protect environment, and recycle the materials. Green building design minimises the negative human impacts on the natural resources. Passive solar building design is one of the subcategories of the green building concept. Execution of the concept of passive solar building design in the tropical countries has a greater potential to reduce national as well as world's fossil fuel consumption. The research shows, apparel industry is one of the major sectors which uses more energy for the production, thermal and visual comfort of employees during the operation as well as for the maintenance purposes. Hence, the energy cost has become a significant issue in many countries including Sri Lanka. The main aim of this research is to identify and analyse the concept of passive solar building design as an energy conservation method for apparel buildings in Sri Lanka. A literature synthesis is carried out on energy conservation methods, design techniques and systems of passive solar building design under the green building concept. Suitability and application of passive solar techniques within Sri Lankan context is identified through the questionnaire survey among the industry experts. The survey found that current usage of passive solar systems in apparel sector is very low. Passive cooling and day lighting systems were identified as suitable techniques to Sri Lanka as a tropical country. Moreover, research findings provide valuable information about buildings based on environmental design tactics, which promote sustainable construction.

Keywords: energy consumption, green building, passive solar techniques, sustainable construction

ID: 167

Inquiry-answer extraction system for disaster risk reduction and the development of sustainable communities

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BELL-CURVE is an EU funded collaborative research project which aims to modernise the Higher Education Institutions (HEIs) in order to make them more responsive to the construction labour market skill needs by continuously improving the skills and knowledge of the construction professionals. To achieve this aim, the Inquiry-Answer Extraction System was developed by using Personalized Multiple Criteria Search Model, which consists from Explicitly and Implicitly Sub-Models. The Personalized Multiple Criteria Search Model stores data that is specific to each individual user. Personalized search depends on a user profile that is unique to the individual. Initial and modification of initial query can be performed by analyzing a system of factors: text materials popularity and reputation, latent semantic indexing, supporting phrases, title and content of the text, behind relevance feedback, keywords density. The Inquiry-Answer Extraction System was adapted for disaster risk reduction and the development of sustainable communities. The Inquiry-Answer Extraction System for Disaster Risk Reduction and the Development of Sustainable Communities is delivering the required quantity of information (amount of pages or number of minutes for reading/reporting/presentation) according to submitted inquiry.

Keywords: inquiry-answer extraction system, disaster risk reduction, project BELLCURVE, case study

ID: 170

APETAU: Shell-system for emergency nursery in post disaster reconstruction – L'Aquila, Italy

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The nursery school APE TAU borns by the idea to realize something useful for l'Aquila after the disastrous Earthquake of 06 april 2009 (Mandrelli, 2009). It is aimed to represent, after the damages caused by the earthquake, a “constructive” and positive idea after, for the youngest children and for their mothers who can, in this way, come back to a work. We are so dealing with a kindergarten, “a nest”, and so the symbol became suddenly the bee (ape in Italian) from which it takes the inspiration for the plan shape and its future and “pollinator joy”, its capability to live in community and to organize itself. Colors are the ones of the bee: yellow and brown body, silver wings. The shape is a bee and also the Saint Francis “Tau”, another positive symbol of peace, rebirth and union that is clearly visible in the plan. APE TAU is technically formed of three covered bodies and a technological cantilever roof leading to the main pedestrian entrance and hosting the vacuum solar panels which helps toward a Net Zero Energy Building (NZEB). Structure is totally dry-assembled with bearing elements in wood or galvanized steel, with inner envelope shell and façades dry stratified and hyper-insulated to gain the maximum comfort in winter and summer. It is a system characterized by high construction speed and high seismic, acoustic, thermal and fire-prevention performances. The building is practically a NZEB, respecting 20-20-20 (2010/31/EU), one as it is also provided with a geothermal heat pump that derives energy deep in the ground. So the Earth which was dramatically shaking, is now bringing energy to the built spaces. The project is based on the use of high-quality materials and devices easily available on the market which were assembled through a continuous integrated design between architects, by the executive and applied ergonomics design, engineers, by calculation and testing, and manufacturers, thanks to products use optimisation, logistics and transportation till the prototype's installation phase. Ape Tau has been realized and designed for free as a charity project.

Keywords: quick-build, high energy efficiency, dry lightweight system, low cost, prefabricated system, seismic resistant

ID: 172

The role of Non Governmental Organization in the livelihood development of the re-settled people in Karainagar after 2009

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The field of Socio-Anthropology has emerged as an important factor in relation to livelihood developmental research in the post war scenario. As the north and east provinces had been destroyed by the internal ethnic conflict that took place in the last three decades. In this regard, the livelihood activities of the north and east provinces were totally destroyed, the people have lost not only the physical resources but also valuable human resources as a consequence, they have been suffering and there is no social development. As soon as the war ended, the government of Sri Lanka announced the cessation of the war; the local and international communities have focused their attention on the resettlement and relief of the affected people. In this context this study attempt to bring out the role of Non Governmental Organization in the livelihood developmental activities of the resettled people in Karainagar after 2009. Karainagr is an island off the north Eastern coast of the Jaffna peninsula where there are 9 Grama Sevegar divisions under the control of the Assistant Government Agent division of Karainagar with an area of 13.3Km square. After 2009, 1631 persons belonging to 638 families were resettled. This study intent to evaluate the progress of the work carried out by the NGO's projects in relation to the upgrading the social life of the resettled people in Karainagar. This study considers only the projects so far implemented ie, the projects in the last one year (2009 to 2010). The specific objectivities of the study are as follows: 1. To Identify the NGO's Projects in relation to the Livelihood Actives. 2. To analyze the impact of its projects on their normal life. 3. To evaluate the peoples participation in the projects of the NGOs.

Keywords: ethnic conflict

ID: 174

Cost benefits of fire protection

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This paper details the results of a questionnaire survey that targeted experts in the field of fire engineering to review current practice within the design process and how designers, architects, fire safety consultants and other professionals view the costs and cost benefits associated with fire protection applied to buildings. The paper concludes that: there is a lack of tools that provide information on the cost benefits of installing protection measures, especially those related to passive fire protection; and that professionals involved in the design of buildings would make use of such a tool.

Keywords: fire engineering, BS 9999, questionnaire survey, passive fire protection; building design tool

ID: 180

Empowering local governments to make disaster resilient cities

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Disasters either natural or man-made cause a significant impact to the entire world. The occurrence of natural disasters has increased significantly in the recent past resulting a higher number of mortalities and economic and social losses. It is evident that the impacts and severity of natural disasters are linked to the unplanned urban development. Due to rapid urbanisation and population growth the cities are becoming increasingly vulnerable to disasters. Therefore there is a high need for disaster-sustainable urban areas in today's context, incorporating proper risk reduction mechanisms to make cities resilient for future disasters. This requires a serious effort of various stakeholders including governmental and non-governmental institutions. The local governments being the first responder and the one responsible for community development, has a key role to play in achieving society's resilience to disasters and to ensure the resilience of the cities under their jurisdiction.

Even though there is a growing concern among the researchers and practitioners on the role of the local governments in making cities resilient to disasters and contributing for the development of disaster resilient cities, several incidents have been reported on the inadequate contribution of local governments in taking the lead role of disaster risk reduction initiatives. This could mainly be attributed to inadequate financial, manpower and other resources available with local governments, lack of willpower and their failure to make timely decisions due to lack of authority. This has emphasised the need for empowering local governments with improved governance structure and the need for developing capacities to lead the concept of resilience in their respective local areas. Therefore the aim of this research is to develop a framework to empower the local governments to make cities resilient to disasters within the context of the built environment and accordingly this paper is focussed on emphasising the need for empowering the local governments.

In this context, this paper highlights the need for empowering the local governments and identifies the ways and means of achieving this in the development of the society's resilience to natural disasters. The literature review technique is used to address this potential issue and the findings are justified through various literature gathered from research papers in electronic databases along with conference proceedings and reports published by various institutions.

Keywords: disaster, empowerment, local government, resilient cities

ID: 184

Adaptation to flood risk: the case of businesses in the UK

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Despite Government investment in flood defence schemes, many properties remain at high risk of flooding. A substantial portion of these properties are business establishments. Flooding can create serious consequences for businesses, including damage to property and stocks, being out of business for a considerable period and ultimately business failure. Recent flood events such as those in 2007 and 2009 that affected many parts of the UK have helped to establish the true costs of flooding to businesses. This greater understanding of the risks to businesses has heightened the need for business owners to adapt their businesses to the threat of future flooding. Government policy has now shifted away from investment in engineered flood defences, towards encouraging the uptake of property level flood resistance and resilience measures by businesses. However, implementing such adaptation strategies remains a challenge due a range of reasons. A review of the current state of property level flood risk adaptation of UK businesses is presented, drawing from extant literature. Barriers that may hinder the uptake of property level adaptation by businesses are revealed and drivers that may enhance uptake and effectively overcome these barriers are also discussed. It is concluded that the professions from the construction sector have the potential to contribute towards the adaptation of business properties and thereby the flood resilience of businesses at risk of flooding.

Keywords: adaptation, businesses, flood risk, resilience, resistance

ID: 185

Building resilience of transport infrastructure through better strategic land use planning

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Transport infrastructure is one of the main critical infrastructure systems that contribute to the resilience of a community in the event of a disaster. Limitations to transport infrastructure create a cascading effect on environmental and other infrastructure systems which affect the society. Failure of transport infrastructure is often linked to many parameters which relate to decisions taken at the strategic planning level. Globally, cities expand annually and urbanisation brings many challenges for the planners. A review of practices adopted in strategic transport planning indicates that major mistakes could occur at the development approval process, where the decisions are made on new transport infrastructure. This paper examines typical strategic land use planning processes for transport infrastructure through a review of published work and Australian policies and standards. The link between the strategic policy documents and the development approval documentation are identified through the analysis of a case study. This process is used to identify the gaps in development approval process which later could lead to the failure of transport infrastructure. A process for quantifying the vulnerability of transport infrastructure is established by analysing the consequences of failure, likelihood and vulnerability of the community. Revisions to the approval processes are proposed at the local government level to reduce the risk of failure of transport infrastructure.

Keywords: strategic land use planning, transport infrastructure resilience, disaster risk mitigation

ID: 186

Lifelong learning needs for disaster management education in the built environment

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Disasters cause considerable damage to the built environment globally. Therefore the capacity to withstand, respond, recover, rebuild, or reinstate the built environment affected by disasters is a key requisite for achieving disaster resilience. The skills and knowledge domain of disaster management is multi-disciplinary and complex. It requires integration of technical, social, economic and many other domains. The success criteria expected from disaster management varies according to type of disaster, resultant damage, context, time, etc. Built environment discipline at each stage of disaster management process has invaluable expertise and a key role to play in the development of society's resilience to disasters. Construction professionals are expected to possess specific knowledge and expertise in this regard. Therefore, the continuous development of disaster management related knowledge and skills of built environment professionals is vital. Lifelong learning is seen as an enabling approach in this regard. HEIs delivering Built Environment programmes are required to play a key role in ensuring that the continuous educational needs of built environment professionals are catered for. The lifelong learning opportunities further enhance this provision as it will facilitate the HEIs to act as a continuing education centres providing skills and knowledge in a dynamic environment. The paper is based on a European Commission funded research project titled Built Environment Lifelong Learning Challenging University Responses to Vocational Education (BELLCURVE), aimed at modernising Higher Education Institution (HEIs) through governance reforms in order to be more responsive to the labour market skills needs. In this context the appropriateness of lifelong learning approach for disaster management education in the built environment is analysed. The complexity of disaster management in terms of its body of knowledge and modes of education are explored. The implications for lifelong learning provision via HEIs are discussed.

Keywords: BELLCURVE, built environment, disaster management education, HEI governance, lifelong learning

ID: 188

Mobile augmented-reality based building information modelling to support disaster preparedness and response

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Key challenges in existing disaster response and recovery processes in highly engineered built environments arise from poor access to the right information at the right time to support critical decision making. The role of Building Information Modelling (BIM) technologies in supporting construction, operations and maintenance of a building is now well documented. This paper focuses on use of BIM-based technologies to serve the information needs during response and recovery operations in urban emergencies. Key literature and emerging technologies are reviewed, followed by presentation of a conceptual architecture. First responders operating in a dynamic disaster response situation need immediate access to relevant information. A key challenge in effective utilisation of BIM during disaster response and recovery is integration of such models with context of the end-user. Context specific access to virtual building models can prevent information overload or information starvation. The paper concludes that integration of context-awareness with BIM has the potential to enhance building information delivery during disaster response and recovery operations by saving valuable time and improving efficiency.

Keywords: building information modeling, augmented reality

ID: 189

Mitigating delays in donor funded road projects: a case study in Sri Lanka

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Delays in donor funded road projects have become inevitable, and an endemic problem in Sri Lanka hindering effective use of foreign aid granted for such projects. This paper mainly identifies significant factors causing project delays and presents strategies and recommendations to mitigate delays in such projects. A road map was first developed to identify the major value adding activities in the process with the main framework being the project management processes defined in the project management body of knowledge. Twenty four projects were examined for quantitative data on time delays, in addition to a comprehensive literature survey and semi-structured interviews. The study revealed an alarming situation that, during the execution process, increase in quantities had significant effect on the project time and accounted for about 56% of the delays. The results also indicated that errors and omissions in detail design, changes in specifications and scope, were the most prevalent sources of quantity increases. Further, during the planning process, the procurement of works activities was delayed by 23% mainly due to shortcomings in contract documents and approvals from relevant agencies. In this context, it is highly recommended to incorporate design constructability review as the major value adding activity in order to minimize the project delays. A rigorous approach by the executing agency is essential to make the aid more effective, accountable and transparent.

Keywords: road construction, delays, donor funded projects, Sri Lanka

ID: 190

Sustainable tsunami warning & evacuation mechanism for Sri Lanka

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Emergency management of tsunamis in the initial stages comprises of tsunami detection, decision making, communication, dissemination of warning and the evacuation. The tsunami warning and evacuation (TWE) process is thus initiated from the detection of a tsunami at one point of the globe and end with the evacuation at another point. Given this complexity, modelling of the TWE process is a challenge as one has to understand international, national and local level activities. In addition, the TWE activities possess characteristic uncertainties in their duration. The most effective way to deal with uncertainty is to collect supplementary information and knowledge. When this is expensive or infeasible, quantification of uncertainty may be performed using analytical or simulation techniques. The simulation provides a valuable insight into the existing systems in place in terms of the adequacy of the time available for warning and evacuation. This methodology revealed the inadequacy of the available time for evacuation in Sri Lanka, particularly in the Eastern region given a tsunami triggering from Sunda trench in the Indian Ocean. This tool can easily be incorporated at the national level for disaster preparedness planning. Given the dynamic nature of the warning and evacuation activities, the duration values and activity relationships need adjustments over the time, which may become a periodical ritual of the governing authority.

Keywords: disaster mitigation, tsunamis, maximum entropy, experts, personal ability

ID: 191

Application of network modeling of fire fighting operations in Calgary for response time minimisation

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Fire service is an essential emergency service within a city dedicated to protect life, property and the environment. All the fire operations are time sensitive and require emergency response on short notice. A fire station's response time to a fire incident is very critical to minimize impacts on lives and properties. The purpose of this paper is to analyze the response time performance of fire fighting operations using the network modeling approach. The firefighting service of the Calgary Fire Department (CFD) was selected as a case study. The sequence of activities in fire response time was identified and developed as a network. The activity durations obtained from estimates quoted by fire officers provided numerical inputs for the network. Initially, the network was simulated using the Decision Support Simulation System (DSSS) tool in Symphony Software to derive a stochastic estimate for the total duration of the response time. In reality, activities are associated with risks. Identification and quantification of risks are important to incorporate risks into activity durations to assess how the total duration changes with risks. As the second step, major risks impacting the response time were identified using a fish-bone diagram and they were used to quantify the overall response time under risks and uncertainties. The delay in response time was identified and possible measures to improve the response time are discussed.

Keywords: fire response time, risks, network modeling, simulation, uncertainties

ID: 192

Investigation of probable maximum precipitation for disaster risk reduction in Sri Lanka

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The torrential rain during January - February 2011 caused many major reservoirs of Sri Lanka to spill and damaged over 400 medium and minor irrigation systems. In this extreme event, during a 30 day period commencing from 15th Dec 2010, Batticaloa experienced its average annual rainfall. The consequences were devastating, with nearly two million people being affected, the loss of 62 lives and severe damage caused to infrastructure. Furthermore, during the last one hundred years, many parts of the country experienced major floods due to extreme rainfall. Given this scenario and serious concerns about climate change, it is vital and prudent to review research methodologies in order to minimize the impact of natural disasters. The failure of a spillway of a large dam could be catastrophic. The design of dams, considering public safety is a challenging task in hydrology. The estimation of Probable Maximum Precipitation (PMP), which is indicative of probable extreme rainfall, is required to assess the adequacy of spillways under the criterion of Probable Maximum Flood (PMF). The objective of this paper is to provide a dependable and realistic method to estimate PMP in the context of Sri Lanka, considering its monsoonal weather pattern and the occurrence of cyclones. While several methods are available to estimate PMP, the hydro-meteorological method and the statistical technique developed by Hershfield are widely used procedures which are also recommended by the World Meteorological Organization. These two methods are characteristic of the deterministic and probabilistic approaches respectively. The physically based hydro-meteorological procedure has been adopted in this study and applied to the annual maximum daily rainfall series from seven meteorological stations. The research shows that maximizing moisture and using the corresponding wind run or maximizing moisture alone, are two realistic scenarios for making reliable estimates of PMP. The findings of this research can be effectively utilized for developing PMP maps for Sri Lanka.

Keywords: probable maximum precipitation, extreme rainfall, moisture maximization, wind maximization, dam safety

ID: 193

Assessment of an existing building using green rating system in Sri Lanka

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Introduction of the green building concept will be ensuring a vital change in the industry of construction in Sri Lanka. Though new, this particular system is widely used by the world of construction making sure that necessary importance is given towards sustainability. The green building concept aims at reducing the constructional impacts towards human health and natural environment and life cycle. It focuses towards reducing the negative impacts in construction by the usage of natural energy, and recycle systems. The main aims of the green building concept is to ensure occupant wellbeing, economic returns of buildings using established and innovative practices, standards and technologies, and improving environmental performance levels. Apart from public health and environment the concept also enhances building and organizational marketability, reduces operating maintenance cost, increases occupant productivity, and helps in creating a sustainable community. The green building rating system is the main factor that needs to be adopted in order to implement the green building concept. It is through the rating system that the performance of an existing or new construction is assessed. In the industry of construction the rating system focuses on energy efficiency, high performance, economical and environmental friendly building systems. The main rating system, contains two sub rating systems which are evaluation of existing buildings and new constructions. The rating system was used to assess the performance of a newly constructed building in Sri Lanka. The findings of the evaluation are presented in the paper.

Keywords: green buildings

ID: 196

Experience of post-Tsunami infrastructure planning, design and construction

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The 2004 Tsunami is the largest natural disaster that Sri Lanka experienced in the recent history. Approximately half a million people displaced from their homes and coastal infrastructure was significantly affected. Consequently, development Partners ranging from private individuals both inside and outside Sri Lanka, government, non-government organizations and development agencies have pledged billions of money in reconstruction projects and resettlement programmes. Most of these projects are already completed where a few of them are heading to the final stages at the moment. If we just look at the character of post disaster development, it can be distinguished as two main categories: resettlement of displaced people by constructing new housing schemes and reconstructing or constructing infrastructure such as hospitals, schools, community halls, etc. The common nature of the resettlement programmes or community housing projects is to settle much as possible families within limited available space including other required infrastructure facilities such as roads, water supply, electricity etc., which sets the planners and designers a difficult task. On the other hand, setting up a public building like a hospital by integrating existing facilities and structures is as well not an easy task. Even though extensive planning was done, the problems that arise during the implementation stage are sometimes beyond our thoughts. Actually, not many of the engineers had the opportunity to involve in this massive development and experience the resilience of post tsunami construction in real life. In this paper, I would like to share my experience, knowledge and the difficulties we faced as engineers during the past 6 years by involving in the process. Primarily, I have concentrated on the wastewater management, water supply and storm-water disposal systems in this paper since they were the most sensitive and challenging areas that I came across during this mission. I hope that this will help our engineers in planning, design and construction stages of the upcoming development, especially on the resettlement and reconstruction programmes brought on by the end of the long spanning civil war, which will be similar to some extent to post tsunami development.

Keywords: post tsunami housing

ID: 198

Effects of bio-mass based pozzolanic material on chloride ion penetration in concrete

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Chloride induced corrosion of reinforcement is a major problem affecting the durability of concrete structures. The required amount of chloride to initiate the corrosion builds up gradually through diffusion from external sources under concentration gradient. The objective was to study the effects of Rice Husk Ash (RHA) on chloride ion penetration in concrete without compromising strength. Test mixes were prepared for six water cement ratios from 0.40 to 0.65 in steps of 0.05 and RHA replacement level was varied from 0 to 20% in steps of 5%. A total of 15 test mixes were identified using a factorial method to perform testing. Concrete containing RHA displays a lower permeability due to changes in the concrete microstructure. The effects of the addition of RHA were evaluated by means of compressive strength and diffusion coefficient. Diffusion coefficient of each sample was evaluated using the Rapid Chloride Penetration Test (RCPT) data. The effect of diffusivity on the concrete cover for a service life of 50 and 100 year was assessed. The results showed that addition of RHA to concrete had a significant improvement on compressive strength and durability. Results showed that the diffusion coefficients of samples reduced with greater RHA% and as a result required concrete cover depth for 50 and 100 year durability reduced significantly. Reactivity index "k" of RHA was determined with respect to strength, charge passed and chloride diffusivity. The reactivity index showed that the RHA has 1.4 times effect towards strength and 4.68 times the effect towards chloride ion diffusivity than that of cement.

Keywords: bio-mass based pozzolanic material, concrete

ID: 199

IT-based health monitoring and risk assessment of bridges

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Bridges are key parts of the road network and it is therefore essential that they should be able to carry the required traffic loads, which may be greater than those for which they were originally designed. The emphasis today is very much on asset management. This means moving away from reactive management and towards targeted schemes which increase the overall value of the bridge stock but at lowest whole life cost. An important activity in asset management is the inspection and assessment process. It is necessary to determine the general condition and structural safety of each item in the overall asset, i.e. each bridge. Having established the current state, it is also necessary to estimate deterioration rates, so that some idea of the residual life of the structure can be determined. This paper will discuss the condition assessment process carried using information technology and sensor networks to predict the remaining life time of the railway bridges in Sri Lanka. In order to achieve the target goals, overall testing and analysis procedure were divided in to several stages. Firstly, a visual observation was carried out and type of measurements and their locations were determined. Secondly, monitoring system based on information technology was established to provide more accurate characteristics of bridge behavior. Displacements, member strains and acceleration of the bridge were investigated under static and moving loading conditions. Three dimensional finite element models for the bridge was developed with general purpose finite element package SAP2000 and model was validated by comparing the experimental data obtained during the health monitoring process. Finally, validated finite element model was analyzed with moving loads and stress cycles for critical members were determined under past, present and future forecasted train schedules. Cyclic stresses obtained from finite element analysis were used to perform fatigue analysis to predict the remaining life time of the structure.

Keywords: bridges

ID: 200

Disastrous conditions in animals in Sri Lanka

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Most disastrous conditions in animals in Sri Lanka are health hazards affecting either, animals only or involve animals and humans. Manmade animal related disasters are becoming important in Sri Lanka while animal concerns during natural disasters, mostly due to floods, are also of some concern. Bird flu (H3N1), a viral condition mostly occurring and spreading via water birds, has taken approximately 300 human lives in more than 30 countries in all continents of the world. Several species of birds could be affected. Currently, it is reported from several countries around Sri Lanka. Though official routes via which birds enter into Sri Lanka could be screened and controlled against the entry of the disease, long standing two migratory routes for birds can not be stopped or screened. Department of Animal Production and Health established several “hot spots” throughout the country which are likely to report the infection within Sri Lanka and keep monitoring all birds and deaths in such “hot spots” once in 6 months. Field diagnostic tests have been provided to peripheral units and committees to handle situations from all aspects have been formed at district level, if this killer disease is introduced. Sri Lanka was exposed to Madcow (BSE) disease in cattle, a nervous condition in cattle, communicable to man. Our regulations were made stronger which reduced the possibility of entry of the germ into the country. Importation of animals and several animal products had to be banned due to the potential of risk of introducing this disease. Approximately 70 people die annually from Rabies in Sri Lanka and most often this is due to a bite of an infected stray dog. Capture and disposal of dogs is not done anymore in Sri Lanka. At least 4 different organizations are working towards reducing the stray dog population. It is anticipated that we, Sri Lanka, eradicate this deadly problem by year 2016. The money allocations by Ministry of Health to prevent Rabies in man, is enormous, which could be reduced if dog population control measures can be implemented leading to reduced Rabies incidence.

Keywords: animal related disasters

ID: 204

Post-Tsunami resettlement in Sri Lanka and India: site planning, infrastructure and services

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After the 2004 Indian Ocean Tsunami, major resettlement programmes were implemented in the affected countries including Sri Lanka and India. Studies of such programmes were conducted in Sri Lanka and India where new settlements were built from scratch on vacant land, which consisted of building new houses and provision of infrastructure and services. Based on interviews of residents and representatives of agencies involved in planning and implementing the programmes, critical aspects of settlement development are reviewed here including site planning, transport, drainage, water supply, sanitation, waste management and security. Notwithstanding the difficulty of implementing such programmes within the constraints of a post-disaster situation, the drawbacks revealed in the studies indicates that residents are confronted with great challenges in inhabiting these settlements. The paper concludes by highlighting the resourcefulness, resilience and adaptive capacity of communities in these settlements for making the settlements more habitable, and the potential for organisations to build more successful settlements by taking these qualities into account.

Keywords: post-tsunami resettlement, site planning, infrastructure, Sri Lanka, India

ID: 205

Community empowerment to enhance mental and social aspects of health in a community after the tsunami in 2004 in Sri Lanka

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Introduction: There were many clusters of temporary shelter set up after the devastating tsunami on 26 December 2004. The concerned intervention, whose effectiveness is studied here, was carried out in one such cluster of shelters near a small coastal town called Panadura. A cooking facility run by hired workers prepared meals for the entire population lived there, which was around 650. The quality of cooked food was poor and people were lined up before serving food. Repeated requests to relevant officials to grant permission for families to cook on their own had been rejected. The components of the intervention were person-to-person communication, group discussions and other group activities, voicing their concerns to relevant authorities, modelling and direct advice/ education under the theme of improving their health and quality of life, which winning the right to cook on their own as they please was one major prerequisite. **Method:** In addition to the test group, another such settlement located about 3 km away, which was similar in many ways, except for the intervention, was selected as the control. Firstly, direct observations were made on apparent associated changes in the communities, namely realisation of their goals, degree of social cohesion, complaints/ satisfaction in relation to the services they received, and their sense of independence and empowerment. Secondly the intervention was compared against the principles laid down by World Health Organisation (WHO) in relation to mental and social aspects of health of populations exposed to extreme stressors. **Results:** Within two weeks the permission was obtained and all families were cooking on their own in the test group. The reporting of complaints regarding food was nil. The control group still did not cook on their own and had probably more complaints regarding food. The degree of social cohesion of the community was more in the test group compared to the control. The intervention appeared to be consistent with most of the principles of WHO. **Conclusions:** This intervention called 'community empowerment' has been associated with positive health/ social changes in a community displaced by tsunami. It was culturally acceptable and was consistent with internationally prescribed guidelines.

Keywords: community empowerment, social cohesion, health, tsunami, Sri Lanka

ID: 206

Development of national drought risk map for improving disaster resilience

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The level of drought risk is often measured by the combination of the degree of exposure to a drought hazard and the level of vulnerability of a community. Accordingly, an assessment of drought risk for Sri Lanka was carried out based on drought hazard index and drought vulnerability index which were derived using meteorological, agricultural, hydrological and socio-economic parameters. Hazard assessment was mainly based on meteorological data such as rainfall and evapotranspiration and therefore, analysis was carried out at the scale of agro-ecological region (AER) depending on the data availability. Drought hazard was assessed using an important attribute of rainfall namely, the deficiency or deficit of rainfall which is derived from the difference between the amount of rainfall and the amount of evapo-transpiration. Monthly and daily deficits were computed for all the AER using 75% probability monthly rainfall, mean daily rainfall and mean monthly and daily ET data. 75% probability monthly rainfall for each AER was obtained from monthly rainfall data for a 10 year period of all the rain gauge stations present in one AER. Mean daily rainfall was calculated from 10 years rainfall records of one selected rain gauge station from each AER. The selection was based on the availability of most recent data and consistent data series without lack of missing data. Monthly ET data were taken from a reliable source and daily ET was derived from those values. Using these monthly and daily rainfall records and deficit values, 14 indices were derived to compute the level of hazard by combining them using Principal Component Analysis (PCA). The vulnerability assessment covered many aspects related to the proneness to drought disaster and ability to overcome it and, it was carried out at the scale of Divisional Secretariats. The composite disaster risk map produced through the combination of hazard and vulnerability profiles are depicted in a GIS platform so that the potential drought risk in a given area or a given locality could be identified interactively along with other useful data for improving disaster resilience of vulnerable communities.

Keywords: drought

ID: 207

SME resilience to extreme weather events: important initiatives for informing policy making in the area

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Enhancing the resilience of local communities to weather extremes has gained significant interest over the years, amidst the increased intensity and frequency of such events. The fact that such weather extremes are forecast to further increase in number and severity in future has added extra weight to the importance of the issue. As a local community consists of a number of community groups such as households, businesses and policy makers, the actions of different community groups in combination will determine the resilience of the community as a whole. An important role has to be played by Small and Medium-sized Enterprises (SMEs); which is an integral segment of a local community in the UK, in this regard. While it is recognised that they are vital to the economy of a country and determines the prosperity of communities, they are increasingly vulnerable to effects of extreme weather. This paper discusses some of the exploratory studies conducted in the UK on SMEs and their ability to cope with extreme weather events, specifically flooding. Although a reasonable level of awareness of the risk was observed among the SMEs, this has not always resulted in increased preparedness even if they are located in areas at risk of flooding. The attitude and the motivation to change differed widely between SMEs. The paper presents schemas by which the SMEs can identify their vulnerability better so that they can be populated among a community of SMEs, which can be taken forward to inform policy making in this area. Therefore the main contribution the paper makes to the body of knowledge in the area is a novel way to communicate to SMEs on improving resilience against extreme weather, which will inform some of the policy making initiatives in the UK.

Keywords: extreme weather events, flood risk, resilience, SMEs

ID: 208

Evaluating the risk of flooding to transport infrastructure using GIS technology

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Floods are not rare incidents in Sri Lanka. Historical record shows that Sri Lanka had experienced with many of catastrophic flood disasters. As a result of flooding, hundreds of thousands of lives, property, physical infrastructures are loss, damaged or destroyed. Especially, the transportation system & its infrastructure that includes roads & railways are frequently affected by floods. Neither a scheduled process nor any other resilience assessment plan or concepts to anticipate and reduce the impacts due to floods are available other than the traditional flood disaster management process of reconstruction. Hence, there is a need for an effective flood resilience assessment process to identify possible risks to the transportation system. Information such as terrain, rain fall, drainage pattern that are relating to the factors affecting flood risk on transportation infrastructure is available in scattered manner. However, this information has not been analyzed in an integrated manner to identify the flood risk on transport infrastructure. Identification of flood risk of existing and proposed transport infrastructure will be very useful to minimize impacts due to any type of flood disaster. The paper presents a methodology developed to identify possible risk areas based on flood information available using Spatial Analyst tool of Arc GIS. Data collection was done based on library & field surveys. Along with the literature survey relevant data such as flood records, physical infrastructures data, geographical & climatic data were collected and a GIS data base was prepared. A methodology was developed to identify possible disaster risk based on the information available using Spatial Analysis, 3D Analysis tools available in Arc GIS for the analysis and to produce results in map media. A case study is presented to illustrate the application of the proposed methodology

Keywords: transport Infrastructure, flood resilience, risk assessment, spatial analysis, disaster management

ID: 209

Incorporating disaster management perspective into built environment undergraduate curriculum

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The built environment profession is primarily concerned with design, construction, planning, procurement, management and technological aspects related to construction and maintenance of built environment structures. Nowadays, nevertheless, there is an emerging need of improving built environmental professionals' role within the disaster management discipline because the built environment has now been realised as a sector that can enormously add value to the entire disaster management process. Provision of higher education in the related areas can be practical means to build disaster management capacities. There are few postgraduate and undergraduate degree courses currently available in the UK to provide disaster management education in relation to the built environment discipline. However, the critical role played by the built environment undergraduate degrees in offering the knowledge and skills relevant to disaster management process is seriously overlooked. The special professional knowledge, skills and competencies that need to be shared across all the built environment professions in relation to the entire disaster management process are established in the current literature. However, less is known about how changes could take place to reflect a disaster management perspective in the built environment undergraduate curriculum. Hence, this paper aims to explore the means of systemising the built environment undergraduate curriculum by integrating the concepts and practices of disaster management. A literature synthesis and a comprehensive desk review were carried out to review the existing UK undergraduate built environment curricular to understand the disaster management aspects placed within them. Finally, the paper maps built environment undergraduate curricular with knowledge and skills needed within the disaster management process in order to identify the gaps for curricular integration.

Keywords: education, capacity building, undergraduate curriculum enhancement, disaster management

ID: 218

Is environmental management a cornerstone of urban disaster resilience? A case study of urban wetlands in Colombo, Sri Lanka

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Colombo is a city surrounded by a large and interconnected system of natural wetlands. Apart from the significance of these wetlands as ecological features in an urban area, they have been providing a range of water and environmental services to the people living in the city and suburbs of Colombo for centuries. The rapid and partly ad-hoc urbanization in the past 15-25 years in Colombo is commonly believed to have caused a steady degradation of these wetlands. Some of the services provided by them have been severely threatened by the degradation and the frequency of urban disasters (such as floods) has also increased during the period. These events increased the risk factors involved in development activities and directly affected the urban poor. Despite many infrastructure and environmental improvement projects and institutional changes in environmental, urban development and disaster management sectors the floods in Colombo city seems to be continuing in a persistent and ever increasing manner. This paper presents a long term research project conducted to understand the nature and extent of degradation in a selected segment of the Colombo Flood Detention Area (CFDA) wetlands. Through analyzing the long term change of landscape level parameters, water-quality, vegetation and soil quality, the authors emphasize the potential of an outright ecological regime change in the wetland system that severely threatens the water related ecosystem services. The paper also qualitatively explores how the gradual changes in watershed and the wetland ecology affected flood control and drainage services leading to full-blown disasters despite the repeated efforts of the authorities to contain them. It underlines the importance of ecosystem health of urban ecological features in strengthening the disaster resilience of cities. The research is an ongoing project and the paper also briefly sketches the theoretical framework of its future undertakings.

Keywords: urban wetlands, urban resilience, ecological regime change, ecosystem services

ID: 219

Empowerment revisited: will it address marginalised positions of women in post disasters?

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World is faced with frequent natural disasters and the magnitude of impact that they cause lead to major concerns in many fields. The need to focus on community engagement and enhancement of society's capacity to withstand disasters in order to reduce damage to both human and material resources has been highly emphasised. Recent studies have reflected the need for gender consideration in disaster management, and emphasised its importance in building disaster resilient communities. Within the post disaster stage, the impact of natural disasters and the consequent partial reconstruction efforts have presented many challenges to women. Hence, there is a need to enhance women's position within post disaster context. Further, many studies have acknowledged that although women are disproportionately affected by these disasters, their role in preventing and mitigating the effects of natural disasters is not well explored. Within this context, the main research investigates into empowerment of women during post disaster reconstruction in Sri Lanka.

Since disasters affect women and men differently and in practice a larger share of benefits of disaster management goes to men, women continue to remain marginalised. Post disaster reconstruction which is, the reconstruction process after a disaster, can provide windows of opportunity for development not only to reconstruct the impacted areas, but also to improve these conditions of the affected population. Although earlier studies have recognised the importance of the concept of empowerment in marginalised conditions literature related to post disaster barely identifies the linkage between the concept and its suitability. Hence this paper seeks to explore these marginalised positions of women in post disasters, examines the concept of empowerment and explores its suitability to address the difficulties of women by bringing forward the evidences from other fields of study. This study has been based on a theoretical as well as practical ideas obtained through a comprehensive literature review and interviews carried out among experts within the practice in Sri Lanka.

Keywords: empowerment, marginalised positions, disasters, post disaster, women
ID: 221

A critical synthesis of the intangible impacts of flooding on households

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The frequency and magnitude of flood events has increased significantly in the last few decades. This can be linked to a number of causes, including changes in climate patterns and urban development. The occurrence of a flood event brings about a range of impacts including tangible or measurable effects and intangible, less quantifiable aspects. The tangible impacts of flooding has generally received greater attention in policy, the media and society, while the intangible impacts have received less attention possibly because they are more difficult to encapsulate and they are generally health related issues. However, there is a growing awareness by flood risk managers that intangible impacts of floods have been underestimated in post-flood appraisals. In an attempt to conceptualise the intangible impacts of flooding on households, a critical synthesis of literature is presented towards developing a deeper understanding of the extent of the effect of flooding on the health of households. The review highlights that the health of households is affected by the stress and disruption caused by having to vacate homes following flood event. This is especially true for the more vulnerable members of the communities and the finding also reveal that the effect could last for months and even years. The implications of these findings are that the health impacts of flooding on households could be greatly reduced by flood mitigation measures such as the take up of property level flood adaptation measures as this will reduce the amount of time households will need to vacate their home for repair works following flood events. There is therefore a need for further research towards improving the quantification of these long term health impacts for the purpose of cost benefit appraisals.

Keywords: adaptation, flooding, flood events, health effect, intangible impact, tangible impact

ID: 222

Seismic hazard and vulnerability in the built environment of Chennai City, India

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Seismic vulnerability in urban areas is the biggest and most rapidly growing problem in developing countries. India has highly populous cities and majority of the construction in Indian cities are not earthquake resistant. Chennai city is one of the well urbanized and densely populated areas of India, where the majority of buildings are reinforced concrete cement structures containing three to four stories. Also the city is listed under GOI-UNDP Earthquake Vulnerability Reduction Programme as one among the 38 urban centres which have more than half million population in India. The Bureau of Indian Standard categorized the city under Seismic zone III (prone to moderate seismic hazard - can expect earthquake magnitude upto 6.9 in this zone). Geologically major part of the city is covered by Recent alluvium to a maximum thickness of 28m and these alluvial deposits can amplify in multi-fold during earthquakes. The damage caused by the past earthquakes in the country reiterates the scale of vulnerability of built environment. Such being the case, safety of the city is extremely important to safeguard the built environment and infrastructures from the earthquakes. The present paper aims to study and understand the vulnerability of the Chennai city's built environment and infrastructure due to earthquakes. The seismic hazard of the city is assessed by integrating geological and geotechnical parameters in GIS platform. A pilot seismic vulnerability study is carried out in the densely populated built areas of the city. A first level rapid visual screening study of buildings is carried out for part of the area. The vulnerability on infrastructure viz., road, railway line, bridges, underground pipelines are mapped using GIS techniques. The seismic vulnerability of part of the city is quantified by integrating the seismic hazard over the built environment and infrastructure details. The out come of study will be helpful in all cases where the vulnerability is assessed to be high, detailed investigations may be required for seismic evaluation of buildings & infrastructures for retrofitting and further building usage purposes.

Keywords: geotechnical, seismic hazard, vulnerability, built environment, Chennai City

ID: 225

Seismic survey and condition assessment of school

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Major economic consequences and losses of lives are evident in recent Tsunami tidal waves that ravaged several countries in the Indian Ocean Rim on December 26, 2004. Although considered a moderate seismic region, in Sri Lanka, the 2004 Tsunami claimed over 38,000 lives and investment need for post reconstruction strategy amounted to \$2,089Mn. Schools are playing vital role in every community. Disaster safe schools must be recognized as a basic human right. This statement is easy to make but difficult to accomplish. Therefore, it is the high time to investigate the disaster vulnerability of important structures such as schools to withstand the future natural disasters. This paper summarizes the outcomes of seismic vulnerability assessment procedure carried out on schools in Eastern Province, Sri Lanka. The typical structural deficiencies found during the investigation are summarized in this paper. The main aim of this work is to identify the existing seismic vulnerable conditions in the school buildings, in order to establish detail investigation procedure to minimize the damages to withstand future disasters. Keywords: future disasters, rapid Visual Screening, structural deficiencies, vulnerability Assessment

Keywords: vulnerability assessment, structural deficiencies, future disasters

ID: 226

Public private community participation programme for water supply in Sri Lanka

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In line with the national policy for millennium development goal, the government of Sri Lanka has planned to provide urban potable water coverage to 100% (1.2 million) of its population by 2025. The call to find more sustainable ways to protect water resources and improve water related services has yielded a number of important strategies. One such course of action is that of "Public Private Community Participation Programme". As the name denotes the approach derives its strength from voluntary collaborations between governments, the private sector and the local communities. To create these relationships is no easy task but the potential of such an alliance to accomplish positive results due to their combined strengths and capabilities is incentive enough for consideration. In this context Public Private Community partnership (PPCP) Programme seems to be appropriate to improve the efficiency and sustainability of water supply service. This paper presents two case studies in Colombo city, where the first and second PPCP programme for urban water were implemented. The research recognized the positive and negative perspectives of the PPCP Programme for water supply by using analysis interviews and questionnaire from public, private, NGOs and community to express comparative and most acceptable idea about its behavior. The paper concludes that based on the research findings and indicated situation of the PPCP programme for water supply in Sri Lanka.

Keywords: public sector, private sector, community based organization, participation, water supply

ID: 227

Road reconstruction in post – disaster recovery; the challenges and obstacles

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Increasing numbers of events and victims caused by natural disaster have been unequally distributed throughout the world. Disfavour to the developing countries, evidence shows that developing countries are more vulnerable to disaster risk due to the significantly larger number of fatal injuries and higher threats to reaching development goals. In the event of natural disaster, road infrastructure appears to be one of the development sectors with the greatest losses and damages. On the one hand, even though road infrastructure plays an important role in accelerating the recovery process, post-disaster reconstruction of road infrastructure has not been adequately determined and has been frequently ignored by many aid agencies giving an extra burden to the community as it adds delays to the recovery process. On the other hand, aid agencies working on reconstruction of road infrastructure may have to face issues that are unique, in context and scale, to post-disaster project in developing countries. Accordingly, this paper tries to identify challenges and obstacles identified in the reconstruction of road infrastructure in Aceh post-tsunami recovery. Since this paper reviews the reconstruction of Aceh post-tsunami road infrastructure as a case study, limitations may then exist to large scale natural disasters in developing countries, and in particular, post-disaster of earthquake and tsunami events.

Keywords: post-disaster reconstruction, road infrastructure, challenges, tsunami

ID: 228

New housing colonies as a means of improving urban living in Nepal

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This paper is based on the theme of UN Habitat 2010 is "Better City, Better Life," representing the common wish of the whole humankind for a better living in future urban environments. This theme represents a central concern of the international community for future policy making, urban strategies and sustainable development. It gives an overview of housing situation and importance of new housing colonies for creating the better urban living in Nepal. Based on the review of research, literature and existing policies, the author has recommended some measures for wonderful urban future.

Keywords: urban living, housing, new housing colonies, better city, better life, Nepal

ID: 229

Push and pull factors of environmental resettlement in Sanjiangyuan Area in China and the effects on the migrants

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Environmental Migration Project in Western China has been a hot issue both in the field of policy making and social studies. Environmental Migration Project in Sanjiangyuan area attracted great attention because it is one of the largest environmental migration projects and also is the most complex and special migration project in China. Environment induced resettlement in Sangjiangyuan area has drawn a lot of attention in China. Based on the survey data and focus group discussion record with government officials, migration village cadres and migrants in 5 counties in Sangjiangyuan area which conducted in July 2009, this paper used the push-pull model to analyze the push and pull factors in origin and destination, the intervening obstacles and the personal factors of the migrants. It also wants to analyze the effects of the resettlement on the migrants. It shows that government policy is the driven factor for the migration, the pull factor of origin is relative weak and the most attractive factor in destination is the better education condition. Several policy applications also were discussed in the paper.

Keywords: push-pull factors, environmental migration, migrants, Sanjiangyuan Area, China

ID: 230

Management of dead in mass disasters – a review of South Asian perspectives

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The first decade of the 21st century will go down in history as an era of major disasters, which occurred in all corners of the world from 9/11 disaster to London bombings, from Asian Tsunami to hurricane Katrina, from earthquakes in India, Iran, Pakistan, China and Haiti to cyclones and floods in Bangladesh and Myanmar and many low grade countless events witnessed in Asian, African and Latin American countries. However the beginning of the second decade was also proved to be relentless with another full scale tsunami disaster experienced in Northern Japan. The common factor of these disasters was the massive number of casualties and deceased witnessed within a very short period of the incident. No disaster recovery process is ever complete without effectively dealing with the massive number of dead. It is only possible through a pre-planned, coordinated process of managing dead. The effective intervention of government agencies to manage casualties in the immediate aftermath of a mega disaster is often restricted by many technical and circumstantial factors. However it was observed during the last decade that in any type of disaster, volunteer members of the affected and surrounding communities form a huge supportive force to meet most urgent tasks including managing dead. This was best witnessed in 2004 Asian tsunami disaster in all affected countries. The first attempt to regularize the community first responder's role in mass disasters was made in 2005 with the post Asian tsunami experience through a joined effort of many international organizations. Since then south Asian countries were more concerned about developing capacity of first responders via community based disaster management schemes. The management of dead in mass disasters is a multidisciplinary and multi stage task. It is a collective function of three interrelated tiers including physical management of dead, information management of dead and supporting bereaved families. This immediate post disaster period requisite is a medico-legal emergency and a tangible marker of effective community resilience. The focus of this paper is on the necessity of managing dead in mass disasters and to assess the effectiveness of community first responders in contributing to this task.

Keywords: mass disaster, dead, management, first responders

ID: 233

Can the game theory concept be applied affectively in post disaster reconstruction decision making?

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Within post disaster reconstruction projects, critical decisions will have to be made about various aspects. These decisions often include affected community's priority needs, nature of the development, relocation strategies, fund availability and disbursements and alike. On the other hand, the decisions made within post disaster scenarios are likely to be affected constrains such as resource availability, governmental policies, community requests and geographical and climatic constrains.

From a different view point, the post disaster decision making process can be looked at from an "opportunistic" view point incorporating concepts such as "Build Back Better". With all these various viewpoints taken into consideration, the nature of the decisions to be made within post disaster reconstruction scenario can be classified as complex and critical. Moreover, almost all the decisions at post disaster reconstruction phase attract opportunity costs. Accordingly, it is important that the effectiveness of this decision making process is maintained at high levels all the times.

Various methodologies and tools are available to make the post disaster reconstruction decision making process robust and logical. Having considered number of such tools and methodologies, this paper discusses the application of the "game theory" with the aim of making this decision making process more effective.

Game theory is a branch of applied mathematics. It is used to mathematically model the behaviour in strategic situations in which the success of one's decision making depends on decisions made by others (or other decisions made related to the same scenario). Within this context, the application of game theory is not a novel approach in social sciences. It has been commonly used in areas such as economics and political sciences to facilitate the decision making process. This focus of this paper is to explore the above applications to understand whether the game theory can be used effectively in post disaster reconstruction decision making.

Keywords: post disaster reconstruction, game theory, decision making

ID: 234

Earthquake risk preparedness plan for Arg-e Bam in Iran

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One of the main challenges in disaster prone countries is planning to reduce the impacts of natural and human-induced hazards. In this regard, the World Heritage Properties are exposed to such disasters, and the loss of these outstanding properties would negatively affect their cultural importance as sources of information about the past and as symbols of identity, as well as their socio-economic value at local, national, and international levels. There are numerous historic properties which have been extremely affected in natural disasters, such as Arg-e Bam in Iran. Bam citadel is an outstanding example of an earthen constructed fortified town, and was unique in its continuous occupation and development over at least 2000 years until 1932. The devastating earthquake of 26 December 2003 in the historic desert city of Bam caused the tragic loss of many lives and the extreme destruction of Arg-e Bam. Afterwards, the Bam and its cultural landscape was adopted on the World Heritage List in 2004. The Bam disaster created new opportunities for Arg-e Bam in disaster mitigation and risk preparedness through the sustainable socio-economic and cultural development of the region. After the earthquake, during the recovery stage, Arg-e Bam had an important role in attracting investors and tourists, and also as a source of employment for local people. Despite this, many World Heritage properties like Bam Citadel do not have any established policy, plan or process for managing disaster risk. This paper attempts to present a process of risk preparedness plan for Arg-e Bam. Such plan includes assessing community support, assets identification, hazard identification, risk assessment, and developing preparedness and mitigation measures. As a result, the plan will reduce consequences of potential hazards at Arg-e Bam and associated community, and so city of Bam can become more sustainable and disaster-resistant.

Keywords: Arg-e Bam, earthquake, risk preparedness, heritage properties

ID: 235

Towards disaster resilient cities in Sri Lanka

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A resilient city is a city that can withstand an extreme natural event without suffering devastating losses, damage, diminished productivity or quality of life and without large amount of assistance from outside the community. This paper intends to provide plausible suggestions to mainstream disaster risk reduction in policies, programs and plans. Sri Lanka has an urban population of around 16.3 % and it is expected that more than 30% of the country's population will be living in cities by the year 2030 (ADB, 2006). The estimated average urban growth rate is 3.1% per year during the period 2005-2015. Among the most pronounced disasters in the urban areas, floods, drought, cyclones, epidemics can be mentioned. According to published reports, occurrence and frequently of these disasters have become more critical on the face of the projected impacts of climate change. While Colombo remains the highest, Kurunegala, Anuradhapura, Kalutara, Ratnapura, Matale, Kandy, Badulla, Puttalam and Hambantota also have been identified as multi hazard prone districts. By way of risk minimization and mitigation it is imperative that action has to be taken at all levels ie policy, program and local levels. Policy guidance can facilitate the zoning of areas according to their suitability such as areas for construction of buildings and roads, areas to be kept under permanent tree cover, areas for public open recreational spaces, areas to house industries and other commercial activities and tourism areas. With regard to the coastal cities, it is imperative to have both physical and biological barriers to curtail the coastal hazards such as cyclones, tornadoes and even tsunamis. At program level, budget has to be allocated for disaster risk reduction and to invest in critical infrastructure ie storm water drainage. Installation of early warning systems which are very useful to identify impending disasters early. The Urban Councils should ensure that all new buildings comply with risk compliant building regulations. The community should be educated on the Disaster risk reduction.

Keywords: disaster, resilience, cities, urban, risk

ID: 238

Tsunami risk assessment and the planning and implementation of strategic mitigation measures - case study city of Galle

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The island state of Sri Lanka was severely affected by the Indian Ocean Tsunami leading to the loss of life, damage to infrastructure and unique eco-systems. In response to this disaster, the Government of Sri Lanka (GOSL) adopted a two pronged approach of immediate response and long term strategic planning to mitigate the impact of disasters and improving community resilience. As part of the latter the GOSL enacted the Disaster Management Act and established the Disaster Management Centre (DMC) to coordinate all disaster management activities at national level and for international liaison. The DMC also promoted scientific research in search of adopting strategic approach for rehabilitation and conservation of the coastline giving due recognition to the fact that the coastal zone of Sri Lanka will remain an important hub for economic activity. It was evident that some cities were severely affected by the tsunami in view of their increased exposure arising from coastline geometry. In particular cities located within bays and around headlands were subjected to extensive damage due to concentration of wave energy. This included principal coastal cities of Galle, Matara and Hambanthota. In addition tsunami waves caused changes in the bottom bathymetry leading to changes in the nearshore wave climate which in the long term will affect coastal erosion trends. For purpose of coastal rehabilitation, conservation and mitigation it was decided to conduct detailed risk assessment studies. Arising from these studies measures were to be identified for, Mitigating the tsunami hazard (reducing the impact of the tsunami wave) Reducing the exposure and vulnerability Enhancing preparedness and evacuation The paper presents a summary of the investigative studies conducted for Risk Assessment for the City of Galle and focuses attention on the development of mitigation measures and their implementation. It was evident that in the case of coastal cities of Sri Lanka the tsunami hazard is of low frequency with potentially high impacts. In that context to invest in costly coast protection measures seems irrelevant unless integrated with national development projects such as port development and therefore attention was focused on harnessing the full potential of bio-shields, community preparedness and resilience.

Keywords: tsunami, risk assessment

ID: 240

Impact of flooding on the value of commercial property in the United Kingdom

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The necessity for estimation of avoided loss in commercial properties has emerged as a serious concept in impact assessment studies. Disasters like flood are increasing with time thus proving importance of estimation of asset values especially to commercial properties. Commercial properties exposed to proximity to flood source, higher probability of occurrence of flood events, and flood characteristics (water depth, velocity and extension) are highly susceptible to flood risk. Lack of insurance against flooding in commercial property sector further aggravate the situation and increases the cost of damage. An estimation of the impact of different components affecting the vulnerability of commercial properties to flood risk and their implications on their market value is important since these factors have not gained much attention so far. Knowledge of impact of flooding on properties will be important for both the stakeholders of commercial property and the insurance companies as lack of flood insurance have been identified as a key determinant in property valuation, transfer and management. This preliminary research as part of a doctoral study examines evidences from previous studies with regard to methods used in estimation of property damage especially for commercial properties and the respective valuation models with reference to the UK market. The review seeks to identify any broad patterns of flood impacts on property market, major concerns of the property holders and to estimate the magnitude of impact. Lessons are drawn from existing literature related to data requirement, choice of methodology, and analysis problems specific to the UK. Market changes have an important effect on the overall valuation pattern; however at this preliminary stage of research the exact change and effect that it has on value of property cannot be succinctly pointed out. The novelty in this research is that no cases have been published directly concerning asset valuation of commercial properties and its relationship in the context of flooding in the UK.

Keywords: commercial property, flood, impact, review, value

ID: 241

Disaster waste management: a systems methodology

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Natural disasters can generate large volumes of debris. In some cases, many years worth of waste can be generated in a single event – overwhelming local solid waste management facilities and personnel. However, the role of debris in disaster management is still largely under-estimated and misunderstood – presenting as more of a logistical technical exercise and road-block to recovery than an action integrated into both the emergency response/recovery and solid waste management system, with social, environmental and economic effects. To research this complex, highly variable and multi-disciplinary problem a systems approach has been adopted. A research model has been developed using primarily qualitative data gathered from five international, multi-hazard, disaster events. The research involves the analysis of six key components of a disaster waste management system for each case study: coordination structures; legislative frameworks; funding mechanisms; implementation strategies; environmental approaches; and public health approaches. For each of the above components a cause and effect analysis was carried out. Causes included contextual constraints and influences such as institutional frameworks and disaster impacts. The effects analysed included timeliness; completeness; environmental; economic; and social impacts of the disaster waste management system. The analysis will be used to develop a framework for designing effective and appropriate disaster waste management programmes. As a result of the 2011 Christchurch Earthquake, the framework will be tested and refined through real-time application, using an active participatory approach during the disaster response. This methodology has allowed for a multi-disciplinary and holistic analysis of a complex problem across many different contexts. The research results have shown strong linkages and synergy between seemingly diverse case studies. These common findings can then be applied to a number of different disaster situations and contexts.

Keywords: disaster research methods, disaster recovery, disaster waste, systems, multi-disciplinary

ID: 242

Building local disaster resilience through international municipal cooperation: experience from selected Asian cities

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Popularly referred to as city-to-city cooperation or C2C, international municipal cooperation is an evolving development cooperation strategy that has increasingly attracted the interest of many local authorities in recent years. Yet in spite of its widespread practice—it is estimated that 70 percent of cities worldwide are engaged in C2C—there is little academic understanding as to how it has been applied to address particular pressing urban concerns such as disaster risk reduction. In recognition of this research lacuna, the paper aimed to investigate the contributions of C2C in reducing local disaster risks in selected Asian cities. It used as a case study the experience of CITYNET, a regional association of local authorities in Asia and the Pacific headquartered in Yokohama, Japan. It described the different modalities by which C2C was carried out by some of the network's member cities, and discussed the prospects and challenges of taking the disaster risk reduction agenda forward as a prominent objective of C2C. It argued that C2C offers an opportunity for local authorities to approach local risk reduction without necessarily “reinventing the wheel” or depending heavily on traditional sources of support. It also highlighted the critical role of city networks like CITYNET in facilitating the implementation of C2C in Asia towards building local resiliency.

Keywords: city-to-city cooperation, international municipal cooperation, disaster risk reduction, CITYNET, Asian cities

ID: 246

Stakeholder expectations of post-disaster housing reconstruction in Sri Lanka: concepts, boundaries and links

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This paper aims to develop a conceptual framework for the stakeholder expectations of post-disaster housing reconstruction in Sri Lanka. In order to do achieve this task an extensive literature survey and expert interviews are undertaken. A conceptual framework provides a technical language system, a set of interpretative principles and important benchmarks for guiding thought. In effect the technical language system tries to depict the research in a diagrammatic form or narrations. This communicates a set of interpretive principles in a coherent manner. Interpretive principles are composed of core concepts, objectives and questions. Benchmarks for guiding thoughts are the outcomes or the recommendations of the research. A conceptual framework also links core concepts, research objectives and research questions while demarcating the boundary of the research. Accordingly, in the journey of stakeholder expectations of post-disaster housing reconstruction in Sri Lanka, the main concepts emerged from literature review and synthesis are; identification and classification of stakeholders; stakeholder power, legitimacy and urgency; post-disaster housing reconstruction in Sri Lanka; stakeholder expectations of post-disaster housing reconstruction; stakeholder expectation gaps of post-disaster housing reconstruction; managing, controlling and monitoring stakeholder expectations and gaps; and strategies to minimise the gaps at each phase of disaster management cycle. Relationships between stakeholders and their expectations of post-disaster housing reconstruction are unearthed in the paper. An iterative process of identification, classification of stakeholders and management, monitoring and controlling expectation gaps leads to explore suitable strategies to manage expectation gaps in each phase of disaster management cycle. Further, the stakeholders are analysed based on power, legitimacy and urgency (proximity). These relationships will lead to recommending suitable mechanisms for effective and efficient delivery of expectations. The Tsunami, 2004 necessitated a large number of post-disaster housing reconstruction projects in Sri Lanka, which form the boundary of this study. Expert interviews enabled refining the conceptual framework and adding the practical flavour in to the research.

Keywords: conceptual framework, disaster management cycle, post-disaster housing reconstruction, stakeholders, stakeholder expectations

ID: 250

Influence of culture towards disaster risk: the case of Barguna, Bangladesh

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The number of disasters has risen sharply worldwide making the risk of disasters a global concern. Over the past years, natural disasters have caused extensive losses and damages to human lives, economy and society. Despite the danger and losses from natural hazards, sometimes people do not attach much significance to them. It is argued that cultural factors such as social values, religious beliefs, traditions, and attachment to a location influence behaviour of people when facing to a hazard. Further, there is a tendency to treat natural hazards as “Acts of God” that are beyond the human control. With this mindset, natural hazards give sense of powerlessness to a community that are subjecting to them. Such attitudes and forces impose on communities from cultural beliefs can adversely affect the strategies that are developed to mitigate disaster risk. On the other hand, there are instances that cultural beliefs have acted as a way of survival for some communities subjecting to disasters. With this context, the study examines influence of culture towards disaster risk. The paper focuses on communities living in Barguna District in Bangladesh with particular reference to the cyclone SIDR that devastated the community in year 2007. Semi structured interviews were used to collect data from a group of community living in Barguna district. Results indicated that local and indigenous knowledge transferred from generations has help communities to predict oncoming disasters; preserve valuable household items and food. The strong cultural beliefs regarding God as a survivor from natural hazards was elaborated from the study. The study takes the way forward as sustaining and integrating with culture that reduces risk, and engaging with culture that increases the vulnerability of communities from disasters.

Keywords: culture, hazard, risk perception, vulnerability

ID: 251

Resettlement activities through spaces and time

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Resettlement programmes have been implemented to relocate people from hazard areas to other safe places. Generally, resettlement programmes consist of several activities upon locations through time. However, the resettlement activities have never been analysed explicitly through these conditions. The lack of this knowledge causes many problems in considering the appropriate places for relocating people. Therefore, this study aims to investigate the resettlement activities and some considered factors by interviewing different roles of people in a hazard community. A case study of Ban Nam Ko sub-district is used to gain the knowledge of resettlement activities in more details. The explored results are presented as some significant milestones and descriptions to explain the resettlement activities. This study is beneficial to the relevant organisations to use the results in planning the places for each resettlement phase through time in order to avoid those inappropriate functions of places.

Keywords: resettlement activities, resettlement programmes

ID: 252

Case study as a research strategy: investigating extreme weather resilience of construction SMEs in the UK

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Determining an appropriate research methodology is considered as an important element in a research study; especially in a doctoral research study. It involves approach to the entire process of a research study, starting from theoretical underpinnings and spanning to data collection and analysis, and extending to developing the solutions for the problems investigated. Research methodology in essence is focused around the problems to be investigated in a research study and therefore varies according to the problems investigated. Thus, identifying the research methodology that best suits a research in hand is important, not only as it will benefit achieving the set objectives of a research, but also as it will serve establishing the credibility of the work. Research philosophy, approach, strategy, choice, and techniques are inherent components of the methodology. Research strategy provides the overall direction of the research including the process by which the research is conducted. Case study, experiment, survey, action research, grounded theory and ethnography are examples for such research strategies. Case study is documented as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. Case study was adopted as the overarching research strategy, in a doctoral study developed to investigate the resilience of construction Small and Medium-sized Enterprises (SMEs) in the UK to extreme weather events. The research sought to investigate how construction SMEs are affected by EWEs, respond to the risk of EWEs, and means of enhancing their resilience to future EWEs. It is argued that utilising case study strategy will benefit the research study, in achieving the set objectives of the research and answering the research questions raised, by comparing and contrasting with the alternative strategies available. It is also claimed that the selected strategy will contribute towards addressing the call for improved methodological pluralism in construction management research, enhancing the understanding of complex network of relationships pertinent to the industry and the phenomenon being studied.

Keywords: case study, construction, extreme weather events, research methodology, SMEs

ID: 254

Status of water quality of Kelani River

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The pollution status of the Kelani river and some of its tributaries were investigated during January to December 2010 with respect to pH, Electrical conductivity, Turbidity, DO, BOD, COD, Chloride, nutrients and microbiological parameters. Also, some heavy metals in dissolved form such as Pb and Cr were analyzed. Principal component analysis revealed that the river water was negatively impacted by pollutants from anthropogenic sources as well as natural sources except turbidity and Coliform in several locations. Seawater intrusion faecal contamination and erosion of the soil into the river water are natural activities stressing the river water quality. Present study revealed that the locations 07005 and 076011 had the least concentration in most of the parameters measured particularly some ionic components, and organic matters pH variation in all locations is within the expectable range (6.5-8.5) except in few locations specially in dry months. The observed DO levels of the river water was moderate (mean value – 4.8 mg/L) while the BOD was < 1 mg /L in most of the locations. Highest COD levels were reported in most of the locations during the period of May to August especially in sampling locations 76003, 76010, 76011 which correlated well with the industrial pollution at these locations. However, a chloride level in the lower reach of the river was on the high side ranging from 80 – 3049 mg/L. The dissolved heavy metal components investigated were less than 0.01 mg/L. Therefore, the water quality monitoring is an essential tool to identify and control both natural and anthropogenic sources of pollution.

Keywords: Kelani River, water quality

ID: 255

National 'Pilisar' waste management programme

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Improper management of municipal solid waste (MSW) is one of the biggest and key environmental problems in Sri Lanka. Lack of organized systems on waste collection, waste transport, intermediate treatment and suitable waste disposal have been contributing to aggravate the solid waste problem in the country. The present haphazard waste disposal practices have created many environmental problems and innumerable nuisances on general public. As a consequence of this practice people are suffering and number of health, social, economic and cultural problems have been created. Because of comparatively poor attention paid to the waste management issue by most of the Local Authorities (LAs) in most parts of the country, the general public has to undergo risks with regard to several SWM problems and the faith they have on the LAS to solve these problems has substantially reduced over the past years. Hence various complaints are being frequently lodged at Central Environmental Authority (CEA) & Ministry of Environment (MOE) against such LAs by the public. On the other hand, the LAS claim that they have been facing numerous problems such as lack of financial provisions, lack of expertise, absence of proper lands for final disposal of waste, inadequate technical knowhow, inadequate staff etc, and because of these they are unable to provide the public a worthy solution. The Government, taking into account the long faced problems by the LAS, setup a national approach for management of MSW in the country by establishing the National 'Pilisar' Solid Waste Management Project (known as Pilisar Project) in the CEA of the MOE with a view to address the issue of improper solid waste management in a nationally coordinated manner. The Pilisar Project (PP) was established in the CEA for a period of three years with effect from 1st January 2008. Total estimated budget allocated by the Treasury for the project is Rs 5.6 billion Considering its importance, project duration has been further extended for a period of another 3 years with effect from 201.

Keywords: waste water management

ID: 256

Detection of flood affected areas of Kalutara District of Sri Lanka by using PALSAR remote sensing and GIS technology

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Floods and droughts are more frequently experienced natural hazards in Sri Lanka. These hazards have a strong impact on the country's socio-economic environment. The government spends large amounts of money annually to provide relief to families affected by natural hazards. Flood hazard ranks high among natural hazards in Sri Lanka. Comparing with the other districts of the country, Kalutara district severely subjects to floods. The floods in May 2003 recorded highest damage since 1992. The heavy rainfall caused severe impact on lives and economic assets of the people. The floods occurred in June 2008 also was serious after the floods in May 2003. Kalutara district is subjected to regular flooding particularly with heavy rains in the upper catchments areas of the Kaluganga, damaging houses, urban centers, schools, the roads network, home gardens, crops, industries and etc. As such inhabitants of this district have been badly affected by frequent floods. Their livelihood and social life have been disturbed. So far, no specific adaptation or mitigatory measures have been taken in this regard.

Keywords: floods, droughts

ID: 257

Knowledge sharing on critical infrastructure facilities for improved disaster resilience: Bangladesh case study

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Infrastructures have been supporting communities since ancient times by providing convenience for daily life and business. 'Infrastructure' is commonly referred to as 'the basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons'. Major disruptions on infrastructure facilities due to natural hazards could result in secondary and further a doubled up impact on the communities due to the fact that the impact on infrastructure creates a vicious cycle, amplifying the impact of the disaster to the affected community. There is a conscious effort for disaster management at national, provincial and sub-provincial level. Despite this, knowledge appears fragmented, although there are undoubtedly many successful practices and lessons to be learned. Due to its large geography, the experiences, lessons learned and good practices on disaster management is not codified and remains with individuals as a tacit knowledge. The research aims to explore means of building resilience on 'critical infrastructure facilities' through sharing of good practices and lessons learned from past disasters. Bangladesh is widely known as a land of natural disasters, particularly for flooding, where disasters have become annual events in Bangladesh and is recognised as one of the most vulnerable countries towards the impact of global warming and climate change, which is mainly due to its unique geographic location, dominance of floodplains, low elevation from the sea, high population density and high levels of poverty. Of all the disasters the problem of flood has aggravated most from 1955 to 2009 and become one of the main concerns of people in Bangladesh. Cyclones, which are sometimes accompanied by storm and tidal surge, pose multiple threats to Bangladesh. The powerful Cyclone SIDR hit the south-western coast of Bangladesh on 15th, November, 2007, damaging many infrastructure facilities. Paper highlights the important of sharing good practices and lessons learned relating to community infrastructure to enhance the effectiveness of disaster mitigation strategies. It discusses lessons that could be learned from super cyclone SIDR to enhance disaster resilience on critical infrastructure facilities.

Keywords: knowledge management, good practices, critical infrastructure, Bangladesh

ID: 258

Mapping scientific progression in built environment disaster resilience

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Recent developments indicate a significant interest in investigating the scientific knowledge domain of the built environment. Lack of explicit theory in built environment is also acknowledged. Science is seen as a multi-layered complex system involving a community of scientists engaged in research using scientific methods in order to produce new knowledge. Thus, the notion of science may refer to a social institution, the researchers, the research process, the method of inquiry, and scientific knowledge. In this paper, the concept of scientific progress is defined relative to each of these aspects of science. Commentaries on history of science acknowledge that the development of knowledge is achieved through progress made in science. The outcomes of this literature review are expected to contribute to developing robust theories, effective solutions in this domain, and to achieving methodological rigour in research.

Keywords: disaster resilience, built environment, scientific progress, knowledge

ID: 259

Integrated strategic environmental assessment for the Northern Province

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Renewal programs that focus on livelihood development of the economically and socially-shattered Northern Province of Sri Lanka brings in new challenges in the form of both the quantity and quality of natural resource availability. In a post-conflict situation it is crucial to provide assurance that robust environmental assessments are in place, where development can be facilitated as quickly as possible while ensuring that the environment receives the best protection. The objective of this study was to rapidly and robustly identify areas of 'environmental opportunity' towards which initial development can be directed while ensuring that the adverse environmental effects are either avoided or minimised.

Environmental assessments can be carried out at a number of subsidiary levels of increasing generality. The Environmental Impact Assessment (EIA) - used to describe the process of environmental assessment which is limited to individual projects such as new harbours, housing developments or roads. The Strategic Environmental Assessment (SEA) is a systematic process of predicting and evaluating the likely environmental effects of implementing a proposed plan or programme in order to ensure that these effects are appropriately addressed at the earliest correct stage of decision-making in tandem with economic, social and other considerations. The Integrated Strategic Environmental Assessment (ISEA) is an advanced version of the SEA process involving data integration and stakeholder co-ordination of many activities by many stakeholders working on many plans and strategies in a specific area to rapidly facilitate post conflict re-settlement and re-development. The ISEA is expected to identify measures that need to be taken to enhance the environmental benefits accrued from development.

The ISEA for the Northern Province was conducted through a broader multi-sector analysis, bringing in planners, implementers and users together from the inception to provide an opportunity for development plans to be sound and sustainable from the outset. The ISEA involved mapping of the "environmentally sensitive" areas (the resource mapping) to provide crucial information to indicate where the potential industry development area, where the development of new infrastructures could be located and from where to extract the material for construction with the minimum impact on biodiversity hotspots. The resource mapping also helped identifying the current disaster risk reduction services provided by the natural ecosystems in the area. Primary and secondary data were collected and compiled and subsequently stored in a GIS type software which were made available and usable for all through the website <http://www.isea.lk>.

The key result of ISEA was the Opportunity Map that would guide the decision-makers in helping the Uthuru Wasanthaya (Northern Spring) programme becoming a reality for the people of the Northern Province as quickly as possible. The ISEA also provided a clear understanding of the expected environmental consequences of decisions that are likely to be made in order to anticipate and avoid adverse impacts arising from implementation of the plan. While seeking answers to issues such as availability of sufficient volumes of ground and surface water for industry and resettlements or sources of building materials and their safe exploitation, equal attention has been paid to the conservation of nature (forests, wildlife, coastal, and wetland) and culture (archaeological sites).

Keywords: environmental assessment, Northern Province, Sri Lanka

ID: 261

INDEX OF AUTHORS

A

Abdul Bari, 60
Abeyruwan, 78
Ahmed, 81
Allan, 46
Amarasinghe, 31
Amaratunga, 1, 2, 10, 24, 35, 36, 44, 57, 63, 67,
70, 88, 93, 106, 107
Asami, 103
Athukorale, 87
Aziz, 71

B

Bajwa, 69
Bakessy, 54
Balendra, 33
Bandara, 85
Barnes, 31
Baroudi, 14
Berse, 103
Bhattacharya, 38, 101
Blanco-Lion, 28
Borna, 5
Bouchlaghem, 66
Brennan, 30
Brewer, 58
Briggs, 96
Brown, 12, 13, 102
Bryant, 46
Buddika, 79
Budryte, 63

C

Chandradasa, 113
Chandrasekera, 83
Chen, 15
Coffey, 39

D

Dangolla, 80
Dareeju, 34
de Alwis, 87
De Silva, 23, 92
de Sylva, 47
Dharmapriya, 51
Dinesh, 60
Dissanayaka, 60

Dissanayake, 52, 79, 91
Doust, 64

E

Edirisooriya Menike, 21
Egodawatta, 31
Ekanayaka, 33
Ekanayake, 52
Ellepola, 113
Enshassi, 6, 7
Ezri, 93

F

Fernando, v, 32, 75, 109
Ferrara, 19
Fujimi, 48

G

Gajendran, 58
Ganapathy, 90
Ginige, 44
Goonetilleke, 31
Gunawardena, 110

H

Haigh, 1, 2, 24, 35, 36, 44, 67, 88, 104
Halwatura, 34, 40
Hammond, 101
Hasbullah, 17
Hettairachchi, 87
Hettiarachchi, 100
Hewage, 53
Howe, 30

I

Imperadori, 19, 64
Indrasiri, 113
Ingirige, 68, 84, 104, 107
Irugalratne, 77

J

Jayarajah, 72
Jayasinghe, 41
Jayasuriya, 42
Jayawardane, 72
Joseph, 89

Index

K

Kakimoto, 59
Kaklauskas, 63
Karannagoda, 43
Kariyawasam, 33
Karunasena, 24
Keraminiyage, 1, 2, 97, 106
Kesavarajah, 9
Kirupananthan, 61
Kulatunga, 1, 2, 51, 52, 55, 105
Kumari, 23

L

Lakmali, 92
Lakshmi Hada, 94
Lamond, 38, 89, 101
Lane, 54
Lawther, 18
Liu, 11

M

MacKee, 58
Maduwanthi, 79
Malalgoda, 67, 70
Mallawatantri, 113
Mannakkara, 37
Marambe, 113
Marforio, 19
Martinez, 27, 29
Matarage, 33
Mattar-Neri, 30
McEvoy, 81
Meegahage, 34
Meng, 45
Milke, 12, 13
Mohamed Harris, 16
Mohomad Saudal Bishar, 43
Mulligan, 4, 8

N

Nadarajah, 4, 8
Naidoo, 26
Neydorff, 62
Nirupama, 25

O

Ophiyandri, 57

P

Palliyaguru, 86
Pamungkas, 54
Paramarajah, 76
Pathirage, 1, 2, 36, 57, 70, 111
Pattukandan Ganapathy, 94
Peiris, v, 52
Pelsmakers, 28
Perera, 96
Piyatadsananon, 106
Ponniah, 61
Porwal, 53
Potangaroa, 26, 27, 29, 30, 37
Prabath, 85
Premalal De Silva, 83
Proverbs, 38, 68, 89, 101
Punyawardene, 83

R

Rajasuriya, 82
Rajawat, 90
Rameezdeen, 42
Ranasinghe, 99
Rapp, 14
Rathnayaka, 23
Ravankhah, 98
Ravinathan, 65
Ruwanpura, 73, 74

S

Sadiqi, 39
Salerto, 20
Salter, 66
Samarakkody Arachchilage, 43
Samaraweera, 21, 22, 23, 55
Samarawickrama, 100
Samith Buddika, 91
Sekar, 90
Semasinghe, 78
Senevirathna, 78
Seneviratne, 35, 36, 78
Setunge, 69
Seville, 12, 13
Shameem, 17
Shanika, 41
Shanmugarajah, 65
Shantha, 22
Shiroshita, 56
Shoman, 7
Siriwardena, 70, 104, 112
Sivalingam, 50

International Conference on Building Resilience 2011

Sivarajah, 49, 50

T

Tamura, 60

Tatano, 48

Thaneeswaran, 49

Thayaparan, 70

Thurairajah, 62, 86, 88

Tjandradewi, 103

Trigunarsyah, 39

U

Ukwattage, 83

V

Vinobaba, 16

Vithanage, 21

W

Waidyasekara, 62

Walawe Durage, 74

Wassell, 89

Wedawatta, 68, 84, 107

Weerasinghe, 33

Weerawansha, 51, 52, 55

Wickramaratne, 73

Wickramasuriya, 75

Wijepala, 41

Wijerathne, 40, 41

Wijeratne, 100

Wijesinghe, 108

Wilkinson, 37

Williams, 86

Wirasinghe, 73, 74

Withanaarachch, 69

X

Xiangjing, 95

Y

Yamada, 59