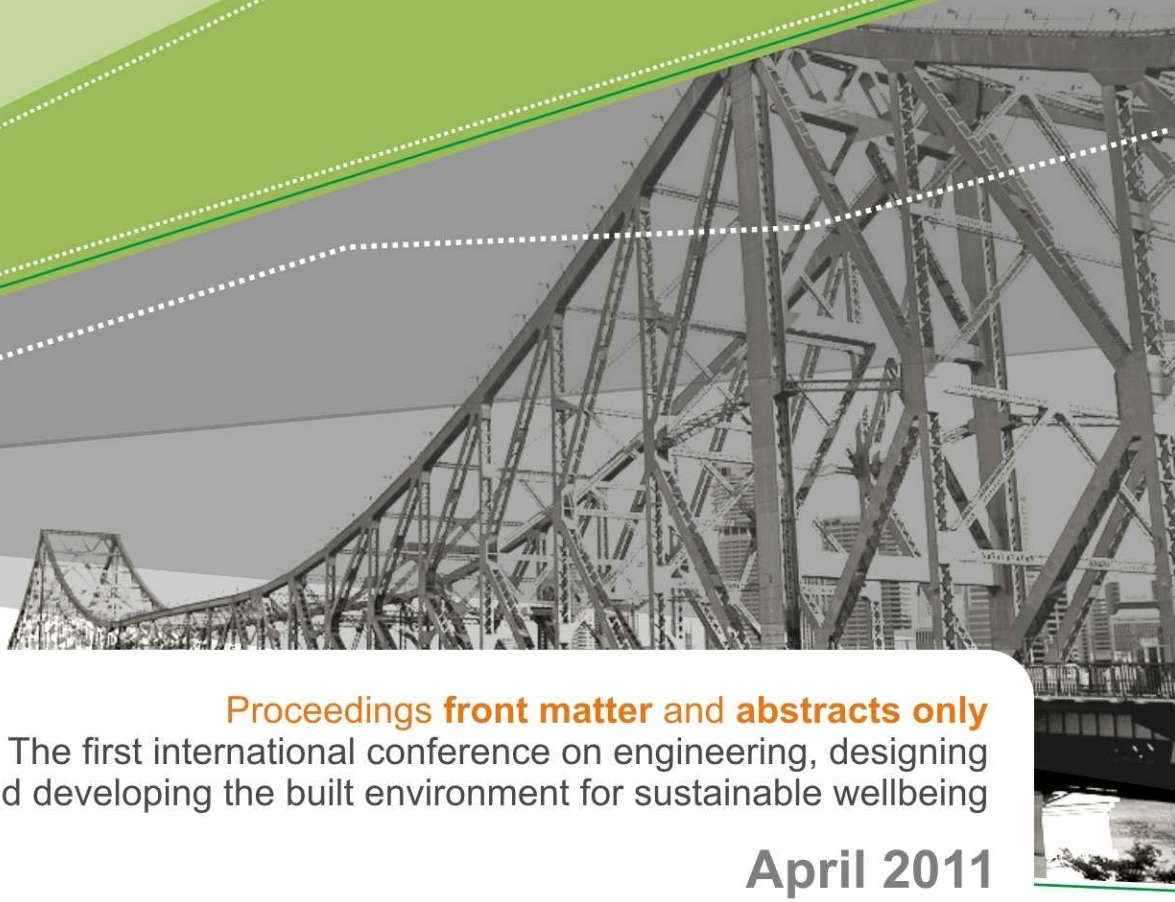
eddBE2011

sustainable wellbeing



Proceedings **front matter** and **abstracts only**

The first international conference on engineering, designing and developing the built environment for sustainable wellbeing

April 2011

FACULTY OF BUILT ENVIRONMENT AND ENGINEERING
BRISBANE, AUSTRALIA

EDITED BY CRAIG J. L. COWLED
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PROCEEDINGS OF THE
FIRST INTERNATIONAL POSTGRADUATE CONFERENCE
ON
ENGINEERING, DESIGNING AND DEVELOPING
THE BUILT ENVIRONMENT FOR SUSTAINABLE WELLBEING

Edited by

Craig J.L. Cowled, Queensland University of Technology

eddBE2011 Proceedings

Proceedings of the first international postgraduate conference on engineering, designing and developing the built environment for sustainable wellbeing

ISBN: 978-0-9805827-4-1

April 2011

eddBE2011, originally planned to occur 7-10 February, 2011, was postponed as a result of disastrous flooding. The conference was held on 27-29 April, 2011, at the Gardens Point Campus of Queensland University of Technology, Brisbane, Australia.

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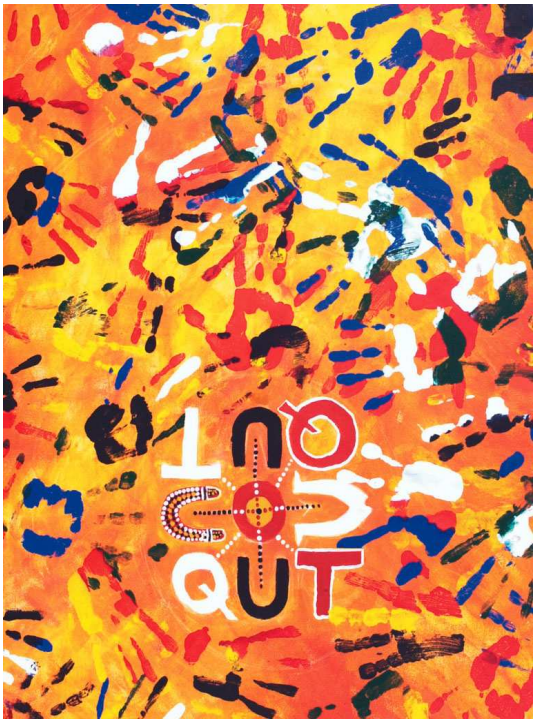

The organising committee of the **eddBE2011** conference acknowledge the Turrbal people as the traditional owners of the land where this conference was held. We also acknowledge the important role that Indigenous people continue to play in Australian society and within Queensland University of Technology.

QUT's goals of teaching and learning, research and community service, and its other activities, are all conducted in the spirit of reconciliation. For more information on QUT's commitment to Reconciliation and the practical steps QUT is making to facilitate Reconciliation, please visit the reconciliation website http://www.reconciliation.qut.edu.au/

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We would like to gratefully acknowledge our sponsors, Queensland University of Technology (QUT), Ergon Energy and NuVasive (AUST/NZ) Pty. Ltd. for their financial support of this event. Our principal sponsor, QUT, is a highly successful Australian university with an applied emphasis in courses and research. QUT has an annual budget of more than AU$500 million that services a student body of 40,000 and a growing number of researchers. Our major sponsor, Ergon Energy, is a state government owned electricity retailer to homes and businesses in regional Queensland with a commitment to enhance the economic and lifestyle aspirations of customers through sustainable energy solutions. Ergon Energy is one of Australia's largest purchasers of renewable energy and is actively involved in alternative energy generation solutions. Our keynote sponsor, NuVasive (AUST/NZ) Pty. Ltd., is a wholly owned subsidiary of the NASDAQ listed NuVasive Inc. which is a medical device company focused on the design, development and marketing of products for the surgical treatment of spine disorders.

FOREWORD

Prof. Martin Betts
Executive Dean,
Faculty of Built Environment and Engineering,
Queensland University of Technology

Welcome to the inaugural Postgraduate Student Conference in the Faculty of Built Environment and Engineering. This conference, the theme of which is Sustainable Wellbeing, addresses an important issue of our time which will impact on all of us as researchers. The challenge for the future is to devise appropriate engineering and urban design systems to meet the emerging needs of society. We hope that this conference embeds in you the philosophy of sustainability in innovation to which QUT is committed.

Queensland University of Technology (QUT) is a highly successful Australian university with an applied emphasis in courses and research, with 40,000 students, including 6,000 from overseas, and an annual budget of more than AU$500 million.

QUT has recently been acknowledged for its world-class research in the Excellence in Research for Australia (ERA) 2010 National Report by the Australian Research Council. The ERA initiative assessed research quality within Australia's higher education providers using a combination of indicators reviewed by internationally recognised experts. In a ratings table compiled by *The Australian*, QUT was ranked among the Top 10 Australian Universities.

The Faculty of Built Environment and Engineering is a major contributor to QUT's research and has enthusiastically embraced the challenge of increasing the quality and quantity of its research outputs in order to grow its research programs, strengthen its disciplinary areas and build capacity in areas of focus that are linked to national priorities. These focus areas of research are Aviation, Energy, Orthopaedics, Intelligent Transport and Complex Urban Systems Design. All areas are underpinned in part by computational modelling and visualisation techniques developed collaboratively within the research groups.

A key characteristic of our programs is collaboration. As part of this, we seek partnerships with industry, with other universities and with institutions, both within Australia and internationally. This conference provides the opportunity for further collaboration among you as postgraduate students, peers and supervisors, both at your respective Universities and QUT. I encourage you to use this opportunity to build your own ideas and directions, visit our facilities and get to know more about research in this Faculty, this institution and within the wider Australian research environment.

My thanks to our sponsors for their moral and financial support of this conference, and I encourage you to take the opportunity to meet with them.

I wish all a successful and enjoyable few days as you share knowledge, experience and build relationships.

Professor Martin Betts
Executive Dean
Faculty of Built Environment and Engineering
Queensland University of Technology

BIOGRAPHY:

Martin Betts's research activities and interests embrace: strategic management in construction, construction IT, construction project management, built environment and engineering education and construction futures. He has been directly involved in research projects funded to over UK£1.5 million. He has personally been responsible for obtaining career research funding from external sources of more than UK£3.5 million. Martin has also received AU$415,000 in funding from the Cooperative Research Centre for Integrated Engineering Asset Management (CR CIEAM) for developing an Integrated Information Model for Community Infrastructure and Asset Management.

Martin is part of an award winning community engagement and research partnership with the Brisbane Airport Corporation which was recognised with the BHERT award of Australia's leading research and development collaboration. Martin has helped secure external funding for research chairs from: Queensland Health, Robert Bird Group, Queensland Rail, Queensland Department of Transport and Main Roads, Queensland Major Contractors Association, the Power Engineering Alliance, the Concrete Masonry Association of Australia and Brisbane Airport Corporation.

Martin has been working in his current role at QUT for eight years, following ten years at the University of Salford as a Senior Lecturer (three years) and Professor (seven years), and five years at the National University of Singapore as a Lecturer (three years) and Senior Lecturer (two years).

PREFACE

Welcome to the inaugural annual international postgraduate conference on **engineering**, **designing** and **developing** the built environment for **sustainable wellbeing**. The conference is proudly hosted by the Faculty of Built Environment and Engineering (BEE), Queensland University of Technology (QUT) and has been organised by a student committee.

Previous postgraduate conferences in BEE QUT have been organised around the individual research themes of Design, Infrastructure, Medical Engineering and Smart Systems. The most recent conferences in each of those themes were:

- Design Theme Postgraduate Student Conference: Diversity and Innovation, Sept 10, 2008;
- The Second Infrastructure Theme Postgraduate Conference, March 26, 2009;
- The Third Smart Systems Postgraduate Student Conference, October 16, 2009; and
- IHBI Inspires Postgraduate Student Conference 2010, November 25-26, 2010.
    - Please note that the annual *"IHBI Inspires"* conferences are organised by the Institute of Health and Biomedical Innovation at Queensland University of Technology and provide a forum for BEE postgraduate students in the former Medical Engineering research theme to present their work, as well as researchers from the Faculty of Health and the Faculty of Science and Technology. The "IHBI Inspires" conferences will continue to be held separately to the **eddBE** conferences. The next scheduled event is "IHBI Inspires Postgraduate Student Conference 2011", to be held at the Royal on the Park, Brisbane, November 24-25, 2011.

eddBE2011 has emerged from the closure of the research themes in 2010 and provides a unique opportunity for postgraduate students from around the world and across a broad range of disciplines to:

- have their work peer reviewed by an outstanding panel of experts;
- present their work to other researchers;
- forge links with future leaders; and
- discover the work being done by researchers in your discipline and other disciplines as well.

In time, it is our hope to see **eddBE** conferences recognised throughout the world as a forum where inspired and innovative postgraduate researchers meet to proudly present their novel work.

As these proceedings were being prepared for publication, the host city of Brisbane was under threat of floodwaters and 75% of Queensland had been declared a disaster zone. QUT was shut down and communications were severely affected. Some members of the organising committee were displaced from their homes by the threat of rising water and no doubt many of the presenters and delegates of this conference were also affected by the floods. Our thoughts are with all those presenters and delegates who have been affected by the floods, particularly those from Toowoomba where some of the worst flash flooding and loss of life occurred.

> *(Ed. The January 2011 flooding in South East Queensland resulted in shocking loss of life as well as significant damage to property. Regrettably, the flooding caused damage to the planned venue of the* **eddBE2011** *conference and also lead to the disruption of supporting services that were required for the successful operation of the event. As such, the organising committee was forced to postpone the event until 27-29 April, 2011. We apologise sincerely for any inconvenience caused.)*

Whether this flooding is a sign of the changing climate or not, sustainability is an issue which must be addressed by Engineers, Designers and Developers in the planning, designing and delivery of all aspects of the built environment. Solutions that balance the needs of the present with the needs of future generations are expected of Engineers, Designers and Developers and it is the work of researchers to provide sustainable solutions that make a positive difference in people's lives. **eddBE2011** gives researchers a platform to demonstrate how their **sustainable** solutions will improve **wellbeing** for people.

Due to the broad range of disciplines represented at this conference, the papers have been divided into four sub-themes:

- Design, Practice, People and Systems;
- Energy, Environment and Sustainability;
- Infrastructure, Transport and Urban Development; and
- Smart and Intelligent Systems.

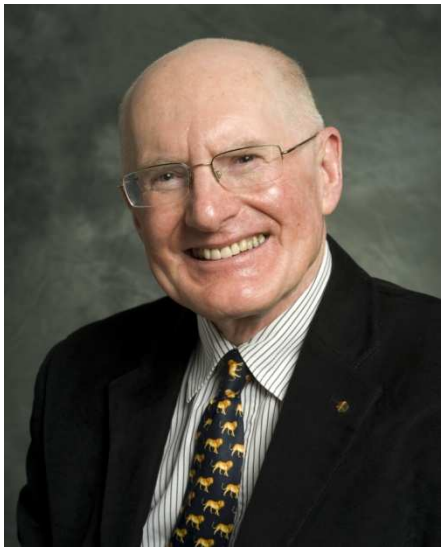
In addition to the papers being presented at this event, other highlights include Keynote Addresses from Adj. Prof. David Hood (Incoming National President, Engineers Australia, Adjunct Professor, Faculty of BEE, QUT, & Chairman, David A Hood & Associates Pty. Ltd.) and Mr. Stephen Dewar (Generation Technical Services Manager, Ergon Energy) and a Plenary Address from Prof. Acram Taji (Director International Graduate Research, QUT). There will be a poster competition as well as best paper and best presentation prizes. Social events include Welcome Drinks and a Buffet Dinner at Old Government House.

The student organising committee has worked very hard to ensure that this conference will be a success and that authors will be proud to see their work published in these proceedings.

The **eddBE2011** organising committee

Craig Cowled, Rebekah Davis, Gary Garner, David Lowe, Buddhi Wahalathantri, and Thedy Yogasara.

KEYNOTE SPEAKERS



Adj. Prof. David A. Hood
Incoming National President, Engineers Australia
Adjunct Professor,
Faculty of Built Environment and Engineering,
Queensland University of Technology, &
Chairman, David A Hood & Associates Pty. Ltd.

KEYNOTE 1:

CAN THERE BE WELLBEING WITHOUT SUSTAINABILITY?

Adjunct Professor David Hood, a civil and environmental engineer with vast experience across major civil and military projects, professional development in emerging economies, senior management in both the public and private sectors, and in engineering education, will discuss how mainstreaming sustainability is critical if we are to survive as a species.

The design, delivery, and operation of our built environment is currently a heavily polluting, resource depleting, and environmentally damaging activity. Despite government incentives, sustainability rating schemes, and guidelines, we continue to degrade natural and social capital through poor planning, bad design, and operation of buildings and infrastructure that considers only the financial bottom line. This paradigm can and must change. David will address the problems and tease out the need for changed thinking if we are to arrive at possible solutions.

Following a successful career in project management, David took over and commissioned Australia's then New Parliament House in Canberra in the mid 1980s - a life changing career episode. Since that project, David has become increasingly involved in fostering a culture of sustainability across all engineering disciplines, and in the built environment.

BIOGRAPHY:

David Hood is a Chartered Professional Engineer, registered on NPER to practice in civil and environmental engineering. David has over thirty five years experience in business, engineering, education, project management, and senior executive positions in both the public and private sectors.

David graduated in civil engineering from the University of Queensland in 1969, and spent ten years in the Royal Australian Air Force as a Commissioned Officer involved with the planning, development, and construction of RAAF bases throughout Australia. After a further seven years as an airport planner, and Project Director with the Federal Department of Aviation, David was appointed Senior Property Executive with the Parliament of Australia where he was responsible for the take-over and commissioning of Australia's then New Parliament House in Canberra. Following the successful start-up of Parliament House, David moved back to the aviation sector where he managed a number of technology IP commercialisation projects, including the establishment of joint venture companies to develop and market air traffic control related software and other products around the world. David then worked as National Manager Aviation and Defence with Maunsell Pty Ltd, before being appointed National Director Engineering Practice with the Institution of Engineers, Australia where he was responsible for technical standards, registration, and the delivery of the Institution's continuing professional development and education programs.

David was a Founding Director of the Australian Construction Industry Forum (ACIF), and of the Australian Council of Building Design Professions (BDP), and was for six years a Councillor, and for three a Director of Standards Australia International.

David is currently Chairman of his own consulting engineering practice specialising in the areas of sustainability in the built environment, "green projects", energy efficiency policy, engineering education and global engineering infrastructure. David has also directed a number of government and industry funded programs throughout South East Asia and Africa assisting the engineering profession in evolving economies with the development of competency standards and assessment processes, practice registration and education upgrading and accreditation systems. As an investor, Chairman, and Board member David led the successful turnaround of CBD Energy Limited, a small public company involved in energy saving technology and solutions for the property industry.

David is actively involved with industry and professional associations promoting the improved energy performance of buildings. David sits on a number of industry, community and university advisory boards where his extensive engineering background, and considerable involvement at a senior level in the built environment sector is influencing change in the "energy culture" of Australia.

David is an Adjunct Professor in the Faculty of the Built Environment and Engineering at Queensland University of Technology, past Chairman of the Australian College of Environmental Engineers, current Chairman of the Australian Green Infrastructure Council (AGIC), and is past Deputy President of the Australian Sustainable Built Environment Council (ASBEC). David is also an accredited presenter on Al Gore's Climate Project, and lectures widely on climate change and sustainability where his passion enthuses others to make a difference and reduce the damage we are inflicting on the earth's systems.

David was elected as a Fellow of the International Society of Engineering Asset Managers in 2010. He was elected Engineers Australia's Deputy National President in November 2010, and will become the 2012 National President in November 2011.

Mr. Stephen Dewar
Manager, Generation Technical Services,
Ergon Energy

KEYNOTE 2:

CHALLENGES OF IMPLEMENTING RENEWABLE ENERGY

Ergon Energy supplies electricity to 97% of Queensland by area. The size and diversity of Ergon Energy's distribution network and generation assets provides unique challenges and opportunities for electricity supply. Ergon Energy has implemented demand and power conservation initiatives and renewable generation technologies.

Electricity supply is a major infrastructure commitment. Sustainable electricity supply in future will need to cater for an adequate response to climate change, higher quality and reliability levels for hi-tech loads, high levels of customer choice and stricter environmental and safety requirements. Ergon Energy has a number of leading edge projects in renewable generation, customer awareness and load profiling to use assets more efficiently.

The future holds many design challenges for electricity suppliers, especially in small isolated systems.

Ergon Energy looks forward to working with the community, industry and educational institutions in meeting these challenges and building its own capacity in this field.

BIOGRAPHY:

Stephen Dewar's diverse and successful career spanning 25 years in engineering, utility infrastructure and asset management has seen him involved in all facets of business management.

Stephen is currently manager of Generation Technical Services. He is an integral part of Ergon Energy's newly created Energy Sustainability & Market Development Group, where he is responsible for the delivery of a wide range of complex and time critical projects.

Stephen is also currently Project Manager on the Windorah Concentrated Solar and Birdsville Geothermal Power Station Projects. He has a unique understanding of the integration of renewable technologies as well as the many challenges associated with deployment throughout mainstream and isolated networks.

PLENARY SPEAKER

Prof. Acram Taji
Director International Graduate Research,
Queensland University of Technology

MY PERSPECTIVE ON MANAGING THE SUPERVISORY PROCESS AND RELATIONSHIP

The sink or swim style of PhD supervision, which was largely characteristic of the time I did my PhD in the 1970s, was neither efficient nor did it produce PhD graduates with appropriate attributes for becoming part of the global workforce. The 21st century model for successful PhD supervision is based on three key elements to build a co-learning relationship between supervisors and PhD students. These aspects are: establishing clear goals—usually framed in terms of finding a researchable question; developing partnerships—by encouraging students to be reflective about the skills and abilities needed to complete the project; and, managing the supervisory process—through regular meetings, writing circles and seminar presentations to provide critiques on progress of the project. Therefore feedback is a critical part of the supervisory relationship and providing feedback is an essential skill, which needs to be learnt and practiced by the supervisors. A key role of a successful supervisor is to promote integration of knowledge and development of higher-order critical thinking and analytical skills in their students.

In this presentation I will provide the audience with my perspective on key elements of successful supervision and managing the supervisory process based on my experience as an international higher degree research (HDR) student in the 1970s in Australia and as supervisor of a large number of HDR students, mostly international students, who competed their PhDs in my laboratory. Many of my former students are now leaders in academia, industry and government organisations around the globe.

BIOGRAPHY:

Acram Taji is a Horticultural Scientist/Crop Physiologist with a Bachelor of Agricultural Science (University Medal) from the University of Tehran, Iran, Graduate Diploma in Horticultural Science from the University of Sydney, PhD in Crop Physiology from Flinders University and a Certificate in Higher Education from Harvard. Acram has taught biology, agronomy, crop physiology, plant biotechnology, horticulture, floriculture and plant biosecurity in a number of universities in Australia, in the University of the South Pacific in Fiji (and its Tonga and the Solomon Islands Centres), the University of Colombo in Sri Lanka, at Osaka Prefecture University and Meiji University in Japan, at University of California-Davis and the University of British Colombia in Canada. She has supervised to completion the research of 45 Higher Degree Research students from 15 countries.

Acram has been the recipient of a number of national and international teaching and research excellence awards including the Australian Society for Plant Propagators' Medal, Japanese Prime Minister Senior Fellowship for foreign specialists, the Australian Award for University Teaching, the Australian Society of Plant Physiologists' Prize, the Australian College of Educators Quality Teaching Award, the International Association for Plant Tissue Culture and Biotechnology's Research Excellence Award, Flinders University Distinguished Alumni, Iranian government highest award of excellence in Science and Technology, International Society for Horticultural Science's Medal of Distinction and the Distinguished Professor Fellowship Meiji University in Japan.

Acram's research focuses on plant growth and development, *in vitro* propagation, and pollination biology and seed set of Australian native plant species. She is also involved in tissue culture for conservation of rare and endangered plants as well as the development of native plant species for floriculture using *in vitro* breeding techniques. She is the author of over 200 articles and the author or editor of 8 books, mostly in the area of plant tissue culture and *in vitro* plant breeding. To date her book "Plant Tissue Culture Practice" has sold over 10,000 copies (translated into Farsi, Indonesian and Arabic) and her video/ DVD "Basic Plant Tissue Culture" has sold over 1000 copies in 62 countries and dubbed into 4 languages (Farsi, Portuguese, Spanish and Arabic). The proceeds and royalties of her books are used to support postgraduate students' research activities.

Acram's administrative positions have seen her served as the Deputy Chair of the Academic Board, Dean of Studies, Vice-Dean of Rural Science and Agriculture, Program Coordinator for International students, Deputy Dean in the Faculty of Sciences, Head of the School of Rural Science, Faculty of the Sciences International Coordinator and the Associate Dean (Teaching and Learning). At present she works as the Director of International Graduate Research at Queensland University of Technology (QUT) in Australia where she oversees all activities with respect to recruitment, admission, progression, educational experience and graduation of international higher degree research students across QUT. Acram is a highly experienced university educator who is passionate about good educational experience for students. Her philosophy underpins her teaching and research. She believes that education is not just about job skills but is about: teaching people to be good global citizens; building cohesive societies; and caring for the environment and for each other.

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SUBTHEME 1:

DESIGN, PRACTICE, PEOPLE AND SYSTEMS

There are eleven papers in this subtheme encompassing such disciplines as Architecture, Landscape Architecture, and Industrial Design and Craft. Designers in these papers have illustrated their influence on the sustainable wellbeing of the community by promoting more sustainable lifestyles, reducing violence in nightclubs through effective design, incorporating urban play into architectural elements, using place-focused design principles for aged care residents, improving accessible housing, using natural ventilation in office spaces, improving product attachment, innovating the craft industry and evaluating landscape character to better understand its value to the community:

The first paper in this subtheme looks at the unsustainable, consumption obsessed nature of home owners attempting to live their ultimate dream, and argues that widespread change is needed in order to shape and sell more sustainable lifestyles to home owners.

The next two papers introduce a review and study (respectively) of the influence of physical environment design on violence in nightclubs and conclude that changes in the design of nightclubs can create an environment that discourages violence.

The fourth paper presents the urban play activity known as parkour and argues that, in order to reduce conflict between authorities and traceurs, urban spaces ought to be designed with play in mind.

The subsequent paper investigates the effect of the aged care built environment's physicality on the 'oldest old' residents and proposes place-focused design principles that improves the wellbeing of residents.

The next paper provides a review of issues surrounding the implementation of universal design requirements for accessible housing in Australia.

The following paper proposes the use of contextual studies in the field of thermal comfort where the more sustainable solution of naturally ventilated (compared to air conditioned) office spaces in sub-tropical regions is feasible.

The next paper seeks to understand 'long term product attachment' as a means of prolonging the longevity, and therefore the sustainability, of furniture.

The third last paper in this subtheme presents a means of incorporating innovative design interventions into the craft industry to reinvigorate the value of a crafted product in consumer's eyes.

The penultimate paper in this subtheme proposes innovation strategies to sustain and foster the traditional craft industry in Indonesia

The final paper in this subtheme presents a new method for evaluating the landscape character of Malaysia's heritage river corridors with the aim that a better understanding of the unique and valued aspects of these river corridors can be preserved and enhanced in future riverfront development.

DESIGN DILEMMA: DRIVING A CONSUMPTION OBSESSED SOCIETY INTO AN UNSUSTAINABLE FUTURE

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Abstract: It is well known that as Australians we have, by global standards, a high standard of living but a wholly unsustainable way of life. There is an urgent need to rationalise the way we establish our home environment and modify it to our specifications, and an equally important need to investigate the way in which design influences the ambitions and aspirations driving the consumption around home-making.

This paper reports on early investigation into everyday design influences on our unsustainable lifestyles with a focus on the domestic housing market, and the process of home-making and re-making. Shelter, security and comfort are fundamental premises of making home, and yet many people have ambitions far beyond the basic requirements when they search for the perfect home environment. Contributions from participants in the author's doctoral study will provide personal reflections on the dilemmas faced by people trying to match their homes with their aspirations and creativity.

It will be seen that the real estate, design and media industries should bear some responsibility for fuelling consumption based behaviour and contribute to reshaping the current desire for a dream home. Re-focusing lifestyle aspirations will also require increasing awareness about the social, environmental and economic benefits of developing creative and craft-based skills through home-focused sustainability practices.

Key words: Aspiration, design industry, real estate, home improvement, consumption.

DANGERS OF THE AFTER-DARK WONDERLANDS: PART A - A REVIEW OF THE IMPACT OF PHYSICAL ENVIRONMENT DESIGN ON NIGHTCLUB VIOLENCE

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Abstract: Nightclubs are businesses. Their business is pleasure; however pleasure has its price. People have become increasingly concerned about the problems of violence in society but why do higher levels of violence occur in nightclubs despite the established patterns of behaviour that dictates how we socialise and act? In response, researchers have focused on identifying social and situational factors that may contribute to violence from a government perspective, focusing on a variety of specific issues ranging from financial standpoints with effective target marketing strategies to legal obligations of supplying alcohol and abiding regulatory conditions. There is little research into specific design properties that can determine design standards to ensure/improve the physical design of nightclub environments to reduce patron violence. To address this gap, this current article aims to understand how people experience and respond to the physical environment of nightclubs and how these spaces influence their behaviour. The first section of this paper examines the background on nightclubs and theories concerning the influence of pleasure. The second section of this paper details the findings of existing studies that have examined the nightlife context and the various factors that influence patron violence. The main finding of this paper is that although alcohol likely plays a contributing role in aggressive patron behaviour, there is evidence that the relationship is moderated by a number of significant factors relating to the characteristics of the drinking environment such as: physical comfort; the degree of overall 'permissiveness' in the establishment; crowding; and physical environmental elements most influenced by day-to-day management practices such as lighting, ventilation, cleanliness and seating arrangements. The findings from this paper have been used to develop a framework to guide exploratory research on how specific elements of the physical environment of nightclubs have an impact on elevated patron aggression and assault (Koleczko & Garcia Hansen, 2011).

Keywords: Nightclub Violence, Bar/Nightclub Design, Environmental Psychology, User Behaviour, Compliance

DANGERS OF THE AFTER-DARK WONDERLANDS: PART B - A STUDY OF THE IMPACT OF PHYSICAL ENVIRONMENT DESIGN ON NIGHTCLUB VIOLENCE

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Abstract: Violence in nightclubs is a serious problem that has the Australian government launching multimillion dollar drinking campaigns. Research on nightclub violence has focused on identifying contributing social and environmental factors, with many concentrating on a variety of specific issues ranging from financial standpoints with effective target marketing strategies to legal obligations of supplying alcohol and abiding regulatory conditions. Moreover, existing research suggests that there is no single factor that directly affects the rate violence in licensed venues. As detailed in the review paper of Koleczko and Garcia Hansen (2011), there is little research about the physical environment of nightclubs and which specific design properties can be used to determine design standards to ensure/improve the physical design of nightclub environments to reduce patron violence. This current study seeks to address this omission by reporting on a series of interviews with participants from management and design domains. Featured case studies are both located in Fortitude Valley, a Mecca for party-goers and the busiest nightclub district in Queensland. The results and analysis support the conclusions that a number of elements of the physical environment influence elevated patron aggression and assault.

Keywords: Nightclub Violence, Bar/Nightclub Design, Environmental Psychology, User Behaviour, Compliance

PLAY IN THE CITY: PARKOUR AND ARCHITECTURE

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Abstract: The ability to play freely in our cities is essential for sustainable wellbeing. When integrated successfully into our cities, Urban Play performs an important role; physically, socially and culturally contributing to the image of the city. While Urban Play is essential, it also finds itself in conflict with the city. Under modernist urban approaches play activities have become progressively segregated from the urban context through a tripartite of design, procurement and management practices. Despite these restrictions, emergent underground play forms overcome the isolation of play within urban space. One of these activities (parkour) is used as an evocative case study to reveal the hidden urban terrains of desire and fear as it re-interprets the fabric of the city, eliciting practice based discussions about procurement, design and management practice along its route.

Key words: Play, City, Urban Space, Parkour, Urban Play

THE BONDAGE OF AN IMPOSED VISUAL DISCOURSE: UNDERSTANDING THE BUILT ENVIRONMENT'S INFLUENCE ON THE 'OLDEST-OLD' AGED CARE RESIDENTS' SENSE OF PLACE

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Abstract: This study investigates the influence of the built environment upon residents' sense of familiarity, concept of self and thus, their facilitation of place through the theory of 'The Bondage of an Imposed Visual Discourse'. Simone de Beauvoir's theory 'The Bondage of Feminine Elegance' provides the conceptual understanding of the visual discourse between the physicality of clothing and the wearer's personal identity. This fashion theory is transposed to explore the influence of the built environment's physicality upon aged care residents' personal identity. This paper presents findings from a study of professionals' opinions in reference to the built environment of permanent residential aged care for the 'oldest-old' of Australia. The researcher conducted qualitative interviews with four participants: an architect, occupational therapist, nursing home facility manager and an aged care lobbyist in the South-East Queensland. This study is structured towards proposing '*place*-focused' qualitative design principles to encourage residents' sense of *place* through the built environment. These proposed principles are addressed with reference to existing Standards and Principles outlined by the Australian Government.

Key words: Bondage, visual discourse, aged care residents, *place*, concept of self, familiarity.

INCLUDED BY DESIGN: A CASE FOR REGULATION FOR ACCESSIBLE HOUSING IN AUSTRALIA

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Abstract: Accessible housing is a scarce yet much needed commodity in Australia. A national agreement between industry and advocacy groups to a voluntary approach, called the Livable Design program, aims to provide access features in all new housing by 2020. Through a range of awareness raising initiatives, the program is anticipating increased supply by builders and increased demand by home-buyers. However the people who need accessible housing are the least likely and least able to buy it at the point of new sale and average home-buyers do not consider access features as a priority.

This approach has not been successful overseas or in Australia in the past. Regulation with incentives supported by education and awareness has provided the best results, yet, regulation typically comes with controversy and resistance from the housing industry. A study is planned to identify how effective the Livable Design program is likely to be, what is likely to hinder it and why regulation is likely to be needed.

Key words: accessible housing, universal design, inclusion, wellbeing.

CONTEXTUAL STUDIES IN THERMAL COMFORT FOR NATURALLY VENTILATED OFFICES IN SUB-TROPICAL AUSTRALIA

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Abstract: Natural ventilation of office environments is considered to be a valid alternative to energy-efficient air conditioning in a future low-carbon economy. However, in Australia, the implementation of passive bioclimatic design strategies for commercial office buildings is rare. This paper introduces a research project which aims to examine the factors influencing the implementation and ongoing success of naturally ventilated office environments in sub-tropical Australia, based on the renovation of existing buildings. As well as looking at issues such as bioclimatic building design and appropriate provision of adaptive building controls, the project will explore the less quantifiable "real-world" factors which make natural ventilation acceptable or unacceptable to office occupants in the sub-tropical region. The paper outlines the argument for contextual studies in the field of thermal comfort, and an example of how this may contribute to our current understanding of occupant satisfaction and passive building design is presented. A pathway for future work as part of this project is put forward.

Key words: Thermal comfort, sub-tropical, natural ventilation, qualitative research.

UNDERSTANDING LONG TERM PRODUCT ATTACHMENT WITH A VIEW TO OPTIMIZING PRODUCT LIFETIME

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Abstract: Technological and fashion obsolescence continue to be concerns in the design of contemporary products. Research shows that consumers dispose of household items even though those are still fully or partly functional, for various reasons. One cause of premature disposal is the lack of emotional attachment between user and product.

Lounge furniture was selected as the product area for this study. The research starts with a literature review on consumer-product attachment, and on design strategies which promote the optimization of product lifetimes, followed by an online survey and in-depth interviews among householders to determine behaviours in furniture usage, maintenance and disposition.

The findings of this research add to understanding of product attachment and detachment stages as well as possible factors that would help designers foster long-term product attachment. The study is intended to add support to a new approach to sustainable design that seeks to extend product lifetimes by designing in the potential for continuation of positive experiences that could lead to the consumer's enduring attachment to particular products.

Key words: product attachment, product detachment, attachment and detachment stages, product lifetime optimization, product person relationship

ARTISAN & DESIGNER: THE RE-DISCOVERY OF KNOWLEDGE HANDED DOWN THROUGH TIME

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Abstract: Craft production is characterized by top manufacturing quality. However, there is no widespread perception of its value, therefore it is hard for this kind of production to enter the market. In this field, a design-oriented approach is essential. Due to its methodology, design can establish a system of universally recognized values, and it can provide craftsmen with the tools to communicate the intrinsic quality of their work to the outside world. The relation between design and crafts becomes fruitful if consumers are able to understand and appreciate the excellence of a craft design production, by recognizing its uniqueness and added value.

Key words: Craft techniques, fashion and textile design, increase in value, implicit and explicit knowledge.

INNOVATION STRATEGIES FOR DEVELOPING THE TRADITIONAL SOUVENIR CRAFT INDUSTRY

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Abstract: This paper describes the concept of innovation strategies for traditional souvenir craft industries. There are many traditional souvenir craft industries in Indonesia, and they have to compete in today's global markets. The craftsmanship and uniqueness of traditional crafts must be developed to attract a larger market. This competition is not easy for craftspeople, neither financially nor culturally. The authors propose some innovation strategies to facilitate craftspeople in generating ideas based on their traditional value, to ensure their sustainability in global context. However, even though there are a number of studies about the craft industry and souvenirs, there is little research focused on the souvenir product development process, especially in the traditional craft industry. Considering that souvenirs are products for pleasure which require hedonic value more than utilitarian value, the offered innovation strategy refers to the strategy applied in existing industries that produce hedonic products. Innovation strategy in the fashion industry is selected as a reference, which is discussed by considering the context of the traditional souvenir craft industry. This investigation will support further research about knowledge sharing systems to enable collaborative learning within traditional craftspeople.

Key words: Innovation strategies, Traditional, Souvenir, Craft.

METHODOLOGY FOR EVALUATING THE LANDSCAPE CHARACTER OF MALAYSIAN HERITAGE URBAN RIVER CORRIDORS

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Abstract: The effects of rapid development have increased pressures on these places exacerbated by the competition between two key industry sectors, commercial base and tourism development. This, in supplement with urbanisation and industrialisation, has posted a high demand for the uses of these spaces.

The political scenario and lack of adaptation on ecological principles and public participations in its design approach have sparked stiff environmental, historical and cultural constraint towards its landscape character as well as the ecological system. Therefore, a holistic approach towards improving the landscape design process is extremely necessary to protect human well being, cultural, environmental and historical values of these places. Limited research also has been carried out to overcome this situation. This further has created an urgent need to explore better ways to improve the landscape design process of Malaysian heritage urban river corridor developments that encompass the needs and aspirations of the Malaysian multi-ethnic society without making any drastic changes to the landscape character of the rivers.

This paper presents a methodology to develop an advanced

Landscape Character Assessment (aLCA) framework for evaluating the landscape character of the places, derived from the perception of two keys yet oppositional stakeholders: urban design team and special interest public. The triangulation of subjectivist paradigm methodologies: the psychophysical approach; the psychological approach; and, the phenomenological approach will be employed. The outcome will be used to improve the present landscape design process for future development of these places. Unless a range of perspectives can be brought to bear on enhancing the form and function of their future development and management, urban river corridors in the Malaysian context will continue to decline.

Key words: Heritage urban river corridor, landscape design process, landscape character assessment, landscape perception, landscape character, urban design team, special interest public, Malaysia.

SUBTHEME 2:

ENERGY, ENVIRONMENT AND SUSTAINABILITY

There are sixteen papers in this subtheme covering such disciplines as Architecture, Construction Management, Materials and Chemical Engineering, Power and Petroleum Engineering, and Water and Environmental Engineering. Each of these papers contribute in some way towards the wellbeing of the community and / or sustainability through improved awareness of sustainability issues, reduced energy consumption, waste generation and emissions, development of sustainable materials that use waste / natural products, carbon capture, optimised power generation, and stormwater composition and treatment:

The first paper in this subtheme looks at the regulated *"sustainability declaration"* at point of sale for residential real estate in Queensland and investigates its level of importance in home purchasing decisions.

The second paper notes that, for households, there appears to be a divergence between knowledge and action on sustainability issues as evidenced by the increasing energy consumption in Perth's households.

The third paper identifies construction and demolition as major contributors to waste generation in Australia, discusses the policy and legislative framework in Queensland regarding waste reduction and recycling, and investigates the feasibility of re-use and recycling of various elements in timber framed 'Queenslander' style residential homes.

The fourth paper provides an overview of the economic, social and environmental benefits of low-cost housing in Malaysia and argues for a "green building" assessment tool that caters for low-cost housing.

The next paper in this subtheme presents test results (physical and mechanical properties) of a new sustainable furniture panel material manufactured with waste products from the food industry.

The subsequent paper provides a review of the properties of sustainable natural fibres, such as flax, hemp and jute, in lieu of synthetic fibres, such as carbon, glass and aramid, in polymer composite materials, and also investigates various processes that improve the performance of natural fibres in polymer composites.

The following paper notes that there is a move away from petro-chemical resins towards bioresins as the feedstock in composite materials, and presents promising preliminary test results on the mechanical properties of epoxidised hemp oil based biocomposites.

The next paper introduces a model for the in situ epoxidation of hemp oil under heterogenous reaction conditions and verifies the model experimentally.

The next paper presents and tests a process for reducing the emissions of volatile organic compounds (VOCs) during the surface finishing process of fibre reinforced plastics with results showing a reduction in VOCs as well as time savings.

The following paper investigates the catalytic reduction of nitric oxide (a harmful smog forming greenhouse gas produced when nitrogen and oxygen are combined at high temperatures as in combustion) with carbon monoxide (a gas present in the flue) as a reducing agent on copper oxide supported on mesoporous alumina.

The next paper presents a numerical investigation of the geomechanical response to increased pressures in an aquifer that is being used for sequestration of carbon dioxide and concludes that the injection of carbon dioxide into an aquifer can cause longterm instabilities in the wellbore region that may lead to fracture of the rock.

The next paper points out that the power generation industry wastes a lot of energy in order to meet peak demands, and proposes a demand side response model whereby the end user is equipped with the tools to manage their own power consumption to take advantage of lower prices in off-peak times, which will ultimately lead to an overall reduction in wasted energy by the power industry.

The following paper presents a predictive model that uses the wavelet transform to identify the occurrence and location of damaging circuit breaker restrikes in high voltage networks with point-on-wave recommendation to extend the service life of SF_6 circuit breakers.

The third last paper in this subtheme presents a new classification system for stormwater treatment devices that enables more consistent comparison of their performance.

The second last paper is a review and gap analysis of scientific and grey literature on the topic of stormwater gross pollutant traps and concludes by demonstrating that eight research gaps were successfully filled by the authors.

The final paper in this subtheme presents a laboratory analysis aimed at identifying the composition and source of solids collected from urban road surfaces along the catchment of the Nerang River, Gold Coast, and draws some conclusions regarding the geographic and anthropogenic influences on the build-up of pollutants.

ASSESSING THE AWARENESS AND IMPORTANCE OF HOUSING SUSTAINABILITY IN QUEENSLAND

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Abstract: Sustainability has been a major factor and determinant of commercial property design, construction, retro-fitting and landlord and tenant requirements over the last decade, supported by the introduction of rating tools such as NABERS and GreenStar and the recently mandated Building Energy Efficiency Certificate (BEEC).

However, the movement to sustainable and energy efficient housing has not been established for the same period, and although mandatory building regulations have been in place for new residential housing construction since 2004, the requirement to improve the sustainability and energy efficiency of housing constructed prior to 2004 has not been mandatory. Residential dwelling energy efficiency and rating schemes introduced in Australia over the past decade have included rating schemes such as BASIX, NatHERS, First rate, ACTHERS, and Building Code of Australia and these have applied to new dwelling construction. At both National and State level the use of energy efficiency schemes for existing residential dwellings has been voluntary and despite significant cash incentives have not always been successful or achieved widespread take-up.

In 2010, the Queensland Government regulated that all homes offered for sale, whether a new or existing dwellings require the seller to provide a "sustainability declaration" that provides details of the sustainability measures associated with the dwelling being sold. The purpose of this declaration being to inform buyers and increase community awareness of home sustainability features.

This paper uses an extensive review of real estate marketing material, together with a comprehensive survey of real estate agents to analyse the current market compliance, awareness and acceptance of existing green housing regulations and the importance that residential property owners and purchasers place on energy efficient and sustainable housing. The findings indicate that there is still little community awareness or concern of sustainable housing features when making home purchase decisions.

Key Words: Sustainability, housing, buyer decision making, buyer preferences, mandatory disclosure.

WHY DON'T WE DO 'THE RIGHT THING'? A PRELIMINARY STUDY OF ENERGY CONSUMPTION IN THE DESIGN, CONSTRUCTION AND USE OF PERTH'S HOUSES

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Abstract: This paper investigates the divergence between what we know and what we do in relation to climate change. According to a recent survey undertaken by the Australian Bureau of Statistics, 73% of Australians are concerned about climate change. Yet in our houses, the domain where the average person is supposed to have the most freedom of choice, we are accelerating climate change by using energy at an unprecedented rate. This is particularly concerning in Australia's fastest-growing city, Perth, where experts predict 700,000 new houses will be required by 2050. As existing stock is gradually replaced, the way we design, construct and use our houses will have ever more impact on climate change. As a prelude to further research, this paper makes some preliminary observations about the ways energy is consumed inside and outside Perth's houses, with a primary focus on the energy embodied within. I examine the results in terms of social theories of consumption and tentatively conclude that the way we consume energy in our houses has little to do with our perceptions of climate change and a lot to do with prevailing political, economic and socio-cultural contexts.

Key words: Consumption, climate change, housing, Perth

AN ASSESSMENT OF TIMBER DWELLINGS TYPICAL OF THE QUEENSLANDER ERA, AND CONSTRAINTS ASSOCIATED WITH THEIR RELOCATION, COMPONENT AND ADAPTIVE REUSE WHEN CONSIDERING 'REGENERATION'

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Abstract: This paper presents an explanation of why the reuse of building components after demolition or deconstruction is critical to the future of the construction industry. An examination of the historical cause and response to climate change sets the scene as to why governance is becoming increasingly focused on the built environment as a mechanism to controlling waste generation associated with the process of demolition, construction and operation.

Through an annotated description to the evolving design and construction methodology of a range of timber dwellings (typically 'Queenslanders' during the eras of 1880-1900, 1900-1920 & 1920-1940) the paper offers an evaluation to the variety of materials, which can be used advantageously by those wishing to 'regenerate' a *Queenslander*. This analysis of 'regeneration' details the constraints when considering relocation and/ or reuse by adaption including deconstruction of building components against the legislative framework requirements of the Queensland Building Act 1975 and the Queensland Sustainable Planning Act 2009, with a specific examination to those of the Building Codes of Australia.

The paper concludes with a discussion of these constraints, their impacts on 'regeneration' and the need for further research to seek greater understanding of the practicalities and drivers of relocation, adaptive and building components suitability for reuse after deconstruction.

Key words: Deconstruction, reuse, adaptation, relocation, regeneration, building components.

LOW-COST HOUSING IN MALAYSIA: A CONTRIBUTION TO SUSTAINABLE DEVELOPMENT?

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Abstract: Rapid urbanization and the scale of new buildings constructed in Malaysia demonstrate an urgent need for change in policy and mode of operation. National energy demand increased by 54% since 1994, which subsequently amplified carbon emissions growth by 221% (per head of population), dubbed highest in the world. Malaysia ranked 66th in the 2009 Human Development Index (HDI); and 54th on the Environmental Performance Index (EPI) in 2010, dropping 27 places from 2008. This indicates that Malaysia's economy and quality of life is improving, but at the cost of the environment. Presently, there is no Malaysian operational definition of sustainable performance in the construction industry, and therefore no consistent framework for assessing building greenhouse gas emissions. It is anticipated that an environmental assessment will prevent further locking in of the country into an unsustainable future. Low-cost housing in Malaysia represents 23.3% of housing targets for 2010, which presents affordable housing in urban areas. The subject of low-cost sustainable housing is still uncharted territory in Malaysia. While low-cost housing contributes to economical and social sustainability, the environmental impact of low-cost housing has yet to be assessed. This paper presents a brief overview to how low-cost housing can contribute to sustainable development's triple-bottom-line.

Key words: sustainable development, low-cost housing, developing country.

SUSTAINABLE FURNITURE PANEL COMPOSITES FROM FORESTRY AND FOOD INDUSTRY BY-PRODUCTS IN AUSTRALIA

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Abstract: This paper presents results of research into polypropylene based wood plastic composites reinforced with food industry and forestry by-products, identified as being particularly abundant in Australia but underutilised, viz. macadamia shells, pine cones and eucalyptus capsules. The present study considers and explores the suitability of these materials for high-moisture environment furniture panel applications. Results are presented for the relevant physical and mechanical properties and are compared with a conventional wood plastic composite utilising radiata pine as the filler.

The water absorption and swelling were generally lower in the forestry and food industry by-product composites than in the conventional radiata pine composite with the best results being obtained for the macadamia nut shell composite. The mechanical properties were however poorer than those of the conventional wood plastic composite. Nonetheless, it is considered that the forestry and food industry by-product composites do provide a viable material and have the potential to become a sustainable replacement option for high-humidity environment furniture panel composites. This would provide much better utilisation of these currently undervalued agricultural waste resources.

Key words: Recycled polypropylene, sustainable composites, macadamia shells, pine cones, eucalyptus capsules.

EFFECTS OF NATURAL FIBRE SURFACE ON COMPOSITE PROPERTIES: A REVIEW

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Abstract: Processing of polymer composites by using green source of fibres as reinforcement has increased dramatically in recent years. Advantages of using natural fibre over man-made fibres include low density, low cost, recyclability and biodegradability. These benchmark properties make natural fibre a potential replacement for synthetic fibres in composite materials opening up further industrial possibilities. However, high level of moisture absorption by the fibre leads to poor wettability and insufficient adhesion within the matrix (interfacial adhesion) resulting degradation of composite properties. These properties hinder the potential of these fibres in providing successful reinforcement for polymer composites. In order to expand the use of natural fibres as successful reinforcement in polymer composites the fibre surface needs to be modified to enhance fibre-matrix adhesion. In this review paper, effects of natural fibre surface on composite properties are discussed. Several fibre surface modification methods are reported and their effects on composite properties are analysed. These properties constitute the prime area of research in developing green fibre polymer composite technologies.

Key words: Natural fibre, surface modification, composite properties.

MECHANICAL PROPERTIES OF EPOXIDIZED HEMP OIL BASED BIOCOMPOSITES: PRELIMINARY RESULTS

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Abstract: Vegetable oils or plant-oils are a sustainable, renewable resource able to be used for the production of bioresins. Oils with high levels of unsaturated fatty acids are used in the production of bio-based epoxy resins for use in biocomposite applications. A novel hemp oil based bioresin, epoxidized hemp oil (EHO) was synthesised at the Centre of Excellence in Engineered Fibre Composites (CEEFC). Biocomposite samples were manufactured from EHO and commercial epoxidized soybean oil (ESO) (for comparison purposes) blended with an amine cured synthetic epoxy resin. Untreated jute matting was used as the fibre reinforcement. Tensile, flexural and impact properties were compared for EHO/epoxy and commercial ESO/epoxy, jute biocomposites. Both EHO and ESO functioned as toughers to the commercial synthetic epoxy resin. Biocomposite samples containing EHO displayed superior mechanical properties than samples containing ESO. It was found that ESO quantities up until 10-20% and EHO quantities up until 30% compared favourably with the commercial synthetic epoxy resin. This comparable performance is attributed to enhanced fibre-matrix adhesion of EHO/ESO and the jute fibres. Overall the results of this preliminary research demonstrate that EHO is an excellent bioresin for use in biocomposite applications, with mechanical properties being comparable to commercial synthetic epoxy (up to 30% EHO content) and superior to commercial ESO across the data range.

Key words: Biocomposite, bioresin, epoxidized hemp oil, mechanical properties, sustainable.

KINETICS OF IN SITU EPOXIDATION OF HEMP OIL UNDER HETEROGENOUS REACTION CONDITIONS: AN OVERVIEW WITH PRELIMINARY RESULTS

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Abstract: Epoxidised hemp oil (EHO) was synthesised in the laboratory by reacting hemp oil (HO) with peroxyacetic acid (PA) in a batch reactor. The peroxyacetic acid was formed *in situ* from acetic acid (AA) and hydrogen peroxide (H_2O_2) in the presence on an acidic ion exchange resin (Amberlite IR-120) as catalyst. The overall reaction can be thought of as having two components. The first being epoxidation, a homogenous reaction which occurs at the interface of the aqueous phase and the HO phase while the second is the formation of PA, a heterogeneous reaction at the interface of the aqueous phase and the solid catalyst phase. The overall reaction kinetics were modelled by applying the Langmuir-Hinshelwood-Hougen-Watson (LHHW) model to heterogeneous reactions. Of the steps in the reaction it is postulated that the formation of PA is rate limiting, while the epoxidation occurs comparatively fast negating the requirement for an additional homogenous model. The diffusion steps in the reaction are also ignored in the kinetic model as it is believed that their effects are negligible due to intensive mixing in the batch reactor. Experiments were used to determine the optimal molar ratios of reactants and it was found that at these conditions 88% conversion of double bonds to epoxy groups occurred. The kinetic model was found to be in good agreement with the experimental results.

Key words: Epoxidation, hemp oil, reaction kinetics, hydrogen peroxide, peroxycarboxylic acid, ion exchange resin, batch reactor, heterogeneous reaction, Eley-Rideal mechanism, Langmuir-Hinshelwood-Hougen-Watson model.

REDUCTION IN EMISSION OF VOLATILE ORGANIC COMPOUNDS IN THE SURFACE FINISHING PROCESS OF FIBRE-REINFORCED PLASTICS THROUGH IN-MOULD THERMOPLASTIC COATING

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Abstract: This paper demonstrates how in-mould coating using thermoplastic materials can be used to replace current solvent based primer coatings in composites manufacturing processes using prepreg layup/autoclave curing. It is shown that emission of volatile organic compounds can be reduced by up to 205g/m^2 of coated area. Two different forms of in-mould coating are introduced, namely thermoplastic film insertion moulding and in-mould thermoplastic powder coating. Mechanical testing, using the single lap shear test, pull-off test and tape test, was conducted to demonstrate that thermoplastic films made from Polyetherimide satisfy existing composite primer adhesion requirements. The results suggest that, even without altering existing top coat and surface preparation procedures, the required adhesion to the substrate and the top coat is surpassed by a factor of 2.4 and 1.4 respectively. Low-voltage scanning electron microscopy suggests that there is diffusion occurring at the epoxy/ polyetherimide interface which leads to more gradual stress distribution across the interface and hence explains the strong adhesion.

Key words: In-mould coating, fibre reinforced plastics, coatings, primer

SELECTIVE CATALYTIC REDUCTION OF NO WITH CO AS A REDUCING AGENT ON CUO SUPPORTED ON MESOPOROUS ALUMINA: EFFECT OF CUO LOADING

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Abstract

CuO supported on mesoporous alumina calcined at 550^{o}C was

studied for Selective Catalytic reduction of NO using CO. Catalysts were prepared via wet impregnation method using copper nitrate as precursor and calcined at 350°C. The obtained materials were studied in the temperature range of 300°C-550°C in fixed bed reactor for NO reduction using CO as reducing agent. The catalysts were characterised by XRD, N_2 adsorption, TEM, TPR, TPD and ICP. The effects of catalysts loading were studied in detail. The Catalysts with 16.76 % wt Cu showed the highest activity for NO conversion at lower temperature compared to Catalysts with 4.56% and 9.72% Cu respectively. Mesoporous alumina did not show No conversion at in the same temperature range. Formation of NO_2 was not observed during NO reduction .Formation of Carbon was observed during NO reduction using CO. Activity of catalysts decreased due to carbon formation on catalyst because of pore blockage. Amount of carbon formed was calculated using TGA analysis. Detailed study of this work is discussed in the paper.

Key words: Mesoporous Alumina, Selective Catalytic Reduction, Copper Oxide, Nitric oxide

HYDRO-MECHANICAL ANALYSIS OF CO2 INJECTION IN AN AQUIFER RESERVOIR

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Abstract: Increase in atmospheric CO2 concentration causes global warming which impacts both the environment and society. Geological storage of CO2 is probably one of the best options to reduce the existing global CO2 concentration. In order to have a successful plan to store the CO2 in underground reservoir the accurate simulation of whole operation seems to be essential. In this study the two phase CO2-brine system flow is simulated to evaluate the distribution of CO2 saturation and average reservoir pressure at different times. The simulated pore pressure is employed to analyse the short and long term geomechanical response of the reservoir. For this purpose a finite element model of coupled poroelastic-two phase flow was developed. Results of this study revealed that a significant change in effective stresses occur near wellbore region in long term CO2 injection. The far field stresses, however, remain almost unchanged. From the numerical experiments it was also found that there is a high increase in reservoir pore pressure around the wellbore for all simulation times. This is due to injection of high compressible CO2 behind the brine with very different mobility.

Key words: Two Phase Flow, Poroelastic, CO_2.

MITIGATION OF ELECTRICITY PRICE/DEMAND USING DEMAND SIDE RESPONSE SMART GRID MODEL

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Abstract: The paper describes a demand-side-response scheme, which enables electricity users to act upon electrical market information provided to them on the internet to be reducing/removing peak demands and the associated escalated energy prices. The proposed scheme enables the customer to manage the use of electric energy using a Demand Side Response smart grid technique in order to curtail or shift loads from peak- to low-demand periods. The technique is using computer-controlled switches and pre-programmed relays able to control loads on user's premises following the network's load profile. This technique is proposed in the first instance for East and South Australia where the Australian Energy Market Operator (AEMO) is publicly communicating information about national electrical energy demand and price on the internet. The scheme is targeting best economic conditions for users, suppliers electrical generators and the electrical network. To evaluate the scheme simulations have been conducted using a typical demand-price profile for Queensland. The results are indicating the impact of this scheme on possible savings in electrical energy consumption.

Key words: Smart grid, demand side response, electrical energy consumption, energy efficiency.

A RESTRIKE WAVEFORM PREDICTIVE MODEL FOR SHUNT CAPACITOR BANK SWITCHING WITH POINT-ON-WAVE RECOMMENDATIONS

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Abstract: Circuit-breakers (CBs) are subject to electrical stresses with restrikes during capacitor bank operation. Stresses are caused by the overvoltages across CBs, the interrupting currents and the rate of rise of recovery voltage (RRRV). Such electrical stresses also depend on the types of system grounding and the types of dielectric strength curves. The aim of this study is to demonstrate a restrike waveform predictive model for a SF_6 CB that considered the types of system grounding: grounded and non-grounded and the computation accuracy comparison on the application of the cold withstand dielectric strength and the hot recovery dielectric strength curve including the POW (point-on-wave) recommendations to make an assessment of increasing the CB remaining life. The simulation of SF_6 CB stresses in a typical 400 kV system was undertaken and the results in the applications are presented. The simulated restrike waveforms produced with the identified features using wavelet transform can be used for restrike diagnostic algorithm development with wavelet transform to locate a substation with breaker restrikes. This study found that the hot withstand dielectric strength curve has less magnitude than the cold withstand dielectric strength curve for restrike simulation results. Computation accuracy improved with the hot withstand dielectric strength and POW controlled switching can increase the life for a SF_6 CB.

Key words: restrike waveform predictive model, circuit-breakers, grounded and non-grounded system, rate of rise of recovery voltage (RRRV), diagnostic algorithm development.

CLASSIFICATION OF STORMWATER TREATMENT DEVICES FOR PERFORMANCE EVALUATION

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Abstract: A large number of stormwater treatment devices are commercially available to meet the need of urban areas. Substantial differences are evident in the way the performance of these treatment systems are evaluated and presented. Various measures to indicate treatment performance are in use and this makes comparisons between different systems difficult. Classification of treatment systems based on performance curves can assist in evaluating treatment systems on a more consistent basis. We focus on physical treatment systems that have robust capabilities to handle high and variable flow rates and are especially suitable for suspended solids removal to achieve non-potable water quality. This paper presents a new classification scheme based on the principal treatment mechanism for screening of treatment system.

Key words: Stormwater treatment devices, classification, suspended solids.

A LITERATURE REVIEW ON RESEARCH METHODOLOGIES OF GROSS POLLUTANT TRAPS

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Abstract: This paper presents a comprehensive review of scientific and grey literature on gross pollutant traps (GPTs). GPTs are designed with internal screens to capture gross pollutants—organic matter and anthropogenic litter. Their application involves professional societies, research organisations, local city councils, government agencies and the stormwater industry—often in partnership. In view of this, the 113 references include unpublished manuscripts from these bodies along with scientific peer-reviewed conference papers and journal articles. The literature reviewed was organised into a matrix of six main devices and nine research areas (testing methodologies) which include: design appraisal study, field monitoring/testing, experimental flow fields, gross pollutant capture/retention characteristics, residence time calculations, hydraulic head loss, screen blockages, flow visualisations and computational fluid dynamics (CFD). When the fifty-four item matrix was analysed, twenty-eight research gaps were found in the tabulated literature. It was also found that the number of research gaps increased if only the scientific literature was considered. It is hoped, that in addition to informing the research community at QUT, this literature review will also be of use to other researchers in this field.

Key words: gross pollutant trap, GPT, literature review, testing, research gap, stormwater.

COMPOSITION AND SOURCE IDENTIFICATION OF ROAD DEPOSITED POLLUTANTS

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Abstract: Road deposited solids are a mix of pollutants originating from a range of anthropogenic sources common to urban land uses and soil inputs from surrounding areas. These particles accumulate potentially toxic pollutants thereby posing a threat to receiving waters. Reliable estimation of sources of particulate pollutants in build-up and quantification of particle composition is important for the development of best management practices for stormwater quality mitigation. The research study analysed build-up pollutants from sixteen different urban road surfaces and soil from four background locations. The road surfaces were selected from residential, industrial and commercial land uses from four suburbs in Gold Coast, Australia. Collected build-up samples were analysed for solids load, organic matter and mineralogy. The soil samples were analysed for mineralogy. Quantitative and qualitative analysis of mineralogical data, along with multivariate data analysis were employed to identify the relative source contributions to road deposited solids.

The build-up load on road surfaces in different suburbs showed significant differences due to the nature of anthropogenic activities, road texture depth and antecedent dry period. Analysis revealed that build-up pollutants consists primarily of soil derived minerals (60%) and the remainder is composed of traffic generated pollutants and organic matter. Major mineral components detected were quartz and potential clay forming minerals such as albite, microline, chlorite and muscovite. An average of 40-50% of build-up pollutants by weight was made up of quartz. Comparison of the mineral component of build-up pollutants with background soil samples indicated that the minerals primarily originate from surrounding soils. About 2.2% of build-up pollutants were organic matter which originates largely from plant matter. Traffic related pollutants which are potentially toxic to the receiving water environment represented about 30% of the build-up pollutants at the study sites.

Key words: Pollutants build-up, Pollutant source identification, Traffic pollutants, Urban water quality.

SUBTHEME 3:

INFRASTRUCTURE, TRANSPORT & URBAN DEVELOPMENT

There are twenty seven papers in this subtheme. The first five papers cover the disciplines of Town Planning, Governance and Construction Management. The research in these papers contributes to community wellbeing and sustainability by preserving cultural heritage, improving community involvement in the processes of government, and improving the planning, safety and longterm sustainability of construction projects:

The first paper in this subtheme addresses the wellbeing of the community as a whole in the context of privately owned heritage in Australia and criticises the position of the Productivity Commission in its inquiry into the conservation of Australia's historic heritage places.

The second paper in this subtheme focuses on governance in Bangladesh and discusses the potential community benefits of incorporating technological innovations that involve the community in the decision making processes of government (dubbed e-governance) with obvious benefits being improved transparency and reduced corruption.

The third paper investigates whole life cycle costing as a means for improving the lasting sustainability of high-rise residential developments in Malaysia.

The fourth paper suggests that the planning and design processes for infrastructure should include consideration of the long term operations and maintenance requirements of a project in addition to constructability issues in order to improve the overall performance of a project.

The next paper proposes a model, based on a literature review, of the factors affecting the safety performance of international construction projects.

The next eight papers in this subtheme cover the disciplines of Geology, Earthquake Engineering and Structural Engineering for earthquake applications. The tests on materials, earthquake analysis techniques and development of structural materials for use in earthquake applications all contribute to improved sustainability of structures that has flow on benefits for the wellbeing of communities:

The sixth paper in this subtheme presents results of laboratory testing of the effects of fatigue on the fracturing resistance of Brisbane tuff rocks and demonstrates that the fracture resistance of the specimens subjected to dynamic cyclic loading was up to 52% lower than those subjected to static loads.

The following paper introduces a more precise computational technique, based on Artificial Neural Networks, for predicting strong ground motion parameters in earthquakes.

The next paper proposes a new damage index for reinforced concrete structures that accounts for cyclic loading.

The following paper provides a numerical assessment of the seismic performance of slip formed load bearing wall panels with different cement:sand ratios and concludes that the optimum ratio is 1:10.

The next paper provides a review of metal yielding devices for passive energy dissipation to absorb earthquake energy and reports on the results of numerical and experimental testing of a new device with a view to developing design tools for the use of Yielding Shear Panel devices.

The next three papers present experimental results of the seismic performance of steel framed walls with three different bracing methods; strap bracing, fibre cement boards bracing and cold formed steel sheet bracing.

The next eight papers in this subtheme cover the discipline of Structural Engineering. The methods and materials that are developed and tested in these papers contribute to optimising the design of structures. This improves the sustainability of structures by reducing the quantity of materials and improving their longevity:

The following two papers describe a new numerical method that has been developed for determining the axial shortening of vertical elements (columns and shear walls respectively) in tall buildings using ambient vibration measurements.

The subsequent paper presents results of impact testing on hollow fibre reinforced plastic sections intended for use as foundation piles in lieu of traditional materials such as reinforced concrete, steel or timber that are prone to degradation, corrosion and deterioration.

The next paper in this subtheme presents experimental test results and a discussion of the flexural performance of a new lightweight composite structural material (glue laminated composite sandwich beam consisting of glass fibre composite skins with a modified phenolic core) for use as structural beams.

The following paper presents presents a finite element model, experimental test results and a discussion of the flexural performance of a new lightweight composite structural material (composite sandwich panels consisting of glass fibre composite skins with a polyurethane core) for use as a floor system.

The subsequent paper investigates the ductility of reinforced concrete beams using 500N reinforcing steel under the provisions of the revised AS3600 code.

The next paper introduces a material model of reinforced concrete, developed for use in finite element modelling, that takes account of the nonlinear behaviour of the material including strain softening, tensile cracking and concrete crushing.

The following paper outlines a finite element analysis of buckle propogation in pipelines that takes into account nonlinearities in material as well as geometry, and notes that the results are in reasonable agreement with previous experimental results.

The last six papers in this subtheme cover the discipline of Transport Engineering. These papers investigate measures for implementing sustainable transport such as non-motorised public transport, public transport and congestion charging.

The next paper in this subtheme discusses the negative impact that transport policy in Dhaka, Bangladesh, has had on the sustainable transport mode of Non-Motorised Public Transport (i.e. rickshaw), and argues that policy makers need to embrace non-motorised public transport as a sustainable element within the overall transport network and move towards better integration within the transport network.

The following paper presents a review of Bus Rapid Transport and outlines an investigation and evaluation of a pilot corridor for Bus Rapid Transport in Dhaka, Bangladesh, with the aim to propose recommendations to transport authorities.

The next paper presents a review of Travel Time Reliability models and the related benefits to reducing congestion within urban road networks.

The third last paper in this subtheme provides an estimate of the latent demand for rail transit in a particular corridor in Perth, Western Australia, using a detailed analysis of available statistical data.

The last two papers in this subtheme present a review of cordoned congestion charging schemes and investigation into the feasibility and effects of implementing such a scheme in Brisbane, Australia.

MANAGING PRIVATELY OWNED HERITAGE IN AUSTRALIA

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Abstract: The Productivity Commission Report of 2006 - Conservation of Australia's Historic Heritage Places (PC Inquiry) constitutes a seminal piece of work with many implications for future policy formation in the cultural heritage sector. It forms the basis of the most comprehensive study of cultural heritage ever undertaken in Australia. The Commission sat in all six states and the two territories over a period of a year and took more than four hundred submissions from a range of heritage professionals and private owners. The aim of the inquiry was to investigate and determine the extent to which Australian governments need to be involved in the regulation of privately owned heritage. A little known fact is that slightly more than 90% of Australia's approximate 150,000 listed items across all Federal, State and local jurisdictions is privately owned.

In Chapter 1 of the PC Inquiry (1.3 - p. 6), it states that in accordance with the Terms of Reference and the broad policy guidelines set out in the *Productivity Commission Act 1998*, the Commission's overriding concern in assessing the existing policy framework and incentives for the conservation of Australia's historic heritage places is the wellbeing of the community as a whole, rather than just the interests of any particular group or industry.

This paper attempts to expose the fact that the PC inquiry breached its terms of reference by focussing its concerns on one particular group – disaffected private owners of heritage. It also shows that the PC Inquiry turned its back on the conservation movement by ignoring the advice given to it by heritage professionals. Whereas heritage professionals were agitating for increased government involvement, the Commission recommended against it. In its draft recommendations it went so far as to suggest that a voluntary negotiation process should replace compulsory listing, but it wound that back in its final report after censorial disapproval was expressed by heritage professionals. The position that the PC Inquiry took in its recommendations is perturbing for the reason that it undermines the fragile structure of heritage practices and ideology in society today. It points to a weakening of the efficacy of cultural heritage in society. It promotes the supremacy of economic factors over heritage as a public good in Australia's regulatory framework.

Key words: Heritage, Management Systems, Productivity Commission, Regulatory Framework

TECHNOLOGICAL INNOVATION IN URBAN PLANNING OF BANGLADESH: SPEEDING UP PLANNING ADMINISTRATION OR ENHANCED COMMUNITY ENGAGEMENT?

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Abstract: Urban planning systems in Bangladesh are characterized by a top down planning approach influenced by politicized patron-client networks and bureaucracy. These have led to a poor governance system because of entrenched corruption and non-participatory planning approach. In this digital age, significant developments in information and communication technology (ICT) have encouraged e-Governance to emerge as a promising means to deliver good governance. It is contended that through e-Governance, local government can ensure efficiency and reduced corruption in the planning systems and improve its capability for effective collaborative decision-making. Based on this hypothesis, the paper discusses the realities of urban government systems of Bangladesh that affects the translation of theoretical possibilities into functioning local planning systems. We argue that technological innovation requires both in routine tasks as well in strategic planning and improved participatory decision-making functions, which has not been incorporated in Bangladeshi planning systems. This paper concludes that a general approach to install an implementation framework of e-Governance may not be effective in this country because of its local political context, corrupted administration and lack of long term planning.

Key words: e-Governance, patron-client network, participatory planning, Bangladesh.

WHOLE LIFE CYCLE COSTING FOR MALAYSIA RESIDENTIAL PROPERTY DEVELOPMENT: THE CULTURE ENVIRONMENT

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Abstract: As knowledge of the residential development costing impact on resource and budgeting use increase, developers are moving towards more sustainable solution by implementing whole life cycle costing. Property management requires an understanding of infrastructure management, service life planning and quality management. Today, people are beginning to realize that effective property management in high-rise residential property can sustain the property value and maintain high returns on their investment. The continuous growth of high-rise residential properties indicates that there is a need for an effective property management system to provide a sustainable high-rise residential property development. For such reasons, this paper attempts to study the culture that have been applied due the residential property development in Malaysia as to improve to the best and sustainable practice in providing the best cost effectiveness management system in residential property development.

Key words: Residential, Whole Life Cycle Costing, Costing.

EFFECTIVENESS OF CONSTRUCTABILITY CONCEPT IN THE PROVISION OF INFRASTRUCTURE ASSETS

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Abstract: The concept of constructability is to use construction knowledge and experience during all phases of a project, particularly in the earliest phases of planning and design. It facilitates project objectives before delivery stage, and decreases unnecessary costs during construction phase.

Despite the extensive use, constructability concept fails to address many issues related to Operation and Maintenance (O&M) of construction projects. Extending constructability concept, to include the O&M issues, could lead to the projects that are not fitted for construction purposes only, but also fitted for use.

This study reviews the literature of constructability implementation, its benefits and shortcomings during the infrastructure life cycle, as well as the delivery success factors of infrastructure projects. This contributes to the propose need of a model to improve the effectiveness and efficiency of infrastructure project by extending the concept of constructability to include O&M. Development of such a model can facilitate post-occupancy stakeholders' participation in a constructability program. It will help infrastructure owners eliminate project reworks, and improve O&M effectiveness and efficiency.

Key words: Constructability, Operation and Maintenance (O&M), Operability, Maintainability, Delivery Phases, Infrastructure Projects, Project Life Cycle, Constructability Extended Concept

A PROPOSED MODEL OF FACTORS AFFECTING SAFETY PERFORMANCE IN INTERNATIONAL CONSTRUCTION PROJECTS

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Abstract: Many international projects are under construction around the world and that trend is likely to continue into the future. The construction industry is considered to be one of the most dangerous industries, representing 30 to 40% of world's fatal injuries. Therefore the requirement of continuous improvement in construction safety performance is imperative. There are many challenges affecting safety performance in international construction projects. Good or acceptable safety practices vary culturally from one country to another, those challenges include socio-cultural, economic, political and legal factors. While a review on the literature shows extensive writing on safety and international construction separately, when these two are integrated research is limited. Moreover, there is a lack of systematic studies investigating the factors which affect safety performance in international construction projects. The aim of this paper is to demonstrate a model summarizing the factors that may affect safety performance in international construction projects.

Key words: International construction projects, safety management, safety performance.

FATIGUE EFFECTS ON FRACTURING RESISTANCE OF ROCKS

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Abstract A series of laboratory diametrical compression tests, referred to as indirect tension tests, were performed on Brisbane tuff disc specimens to investigate their mode I fracture toughness response to static and cyclic loading as a function of the applied load. Both the static and cyclic loading tests were carried out on Cracked Chevron Notched Brazilian Disc (CCNBD) rock specimens. In the tests described herein, the reduction in fracture toughness under dynamic cyclic loading was found to be up to 52% of static fracture toughness. The experimental results showed continuous irreversible damage accumulation at the tip of the chevron notched crack in the dynamic cyclic tests, strongly influenced by the loading amplitude. Contrary to the static tests, the cyclic tests produced much more crushed material in front of the tip of the chevron notched crack. It was concluded that cyclic loading causes many micro-cracks, resulting in an extensive Fracture Process Zone (FPZ) in front of pre-existing cracks in rocks.

Keywords: CCNBD specimen, rock fatigue, sub-critical crack, tensile cyclic loading

ESTIMATION OF STRONG GROUND MOTION PARAMETERS USING ARTIFICIAL NEURAL NETWORKS

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Abstract: This paper aims to predict ground acceleration, speed, and maximum displacement using Artificial Neural Network (ANN). Database of Next Generation Attenuation (NGA) project are employed for training and testing of the neural network. In the selected learning algorithm, the average speed of the shear wave in the top 30 metres, focal depth, magnitude and distance to source are the input variables, and Peak Ground Acceleration, Velocity and Displacement (PGA, PGV and PGD) values are used as output. Close match between the predicted values of the deployed method with the observed values and its ability to reduce or even eliminate the uncertainties in the attenuation relationships show that this method can be used as a reliable method for predicting the main parameters of strong ground motions. The results indicate successful performance for the artificial neural network algorithm in predicting the expected results. They also show that the faults with reverse-oblique mechanism in constant earthquake magnitude and assuming equal average speed of the shear wave and focal depth generate higher values for PGA, PGV and PGD Parameters.

Key words: spectral acceleration, attenuation relationship, neural network, estimation, earthquake parameter.

A NEW DAMAGE INDEX FOR REINFORCED CONCRETE STRUCTURES SUBJECTED TO SEISMIC LOADS

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Abstract: Reinforced concrete structures are likely to experience some damage when subjected to earthquake loading. Damage index is a well accepted way of expressing the extent of damage and is widely used by researchers. Last few decades have seen many concepts for calibrating an appropriate damage index being proposed. This paper presents a detailed review of available concepts by classifying those into two broad categories: non-cumulative and cumulative. Non-cumulative indices do not include the effects of cyclic loading, whilst the cumulative indices are rather more rational. It is however observed that most of the existing damage indices are unable to accurately describe the state of damage of reinforced concrete structures. An ideal damage index should vary within a scale of 0 to 1 with 0 being the state of elastic response whilst 1 should refer to collapse; most of the existing damage indices do not satisfy this criteria. A new damage index based on the hysteretic energy is proposed herein and its performance is compared against the widely accepted concept proposed by Park and Ang (1985) in the case of a column subjected to compulsive cyclic displacement at top. The proposal is still at preliminary stage but it meets the essential criteria for a damage index.

Key words: Damage index, hysteretic energy, reinforced concrete, seismic load.

SEISMIC CAPACITY OF BUILDING CONSTRUCTED IN SLIP FORMED LOAD BEARING WALL PANELS

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Abstract: Constructing buildings using slip formed load bearing wall panels is becoming increasingly popular in Sri Lanka due to several advantages; low cost, environmental friendliness and rapid construction technique. These wall panels are already successfully implemented in many low rise buildings. However, the seismic capacities of these buildings have not been properly studied. Few seismic activities reported in Sri Lanka have not caused severe structural damage, but predictions can not be made as to whether this will continue to be the case in the future. This highlights the need to study the seismic capacity of buildings constructed in slip formed load bearing wall panels. This paper presents a study of the seismic capacity of the existing medium rise building.

Key words: .Pushover Analysis, Slip Formed Load Bearing Wall Panels, Rankin Failure Criterion. Finite Element Analysis

METAL YIELDING DEVICES FOR PASSIVE ENERGY DISSIPATION: REVISITING THE TREND WITH A NEW CONCEPT

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Abstract: Earthquake is one of the most catastrophic natural events that affect civilization causing loss of human lives and destruction of cities; recent earthquakes in the Asia-Pacific region highlight the importance of further research to develop sustainable techniques to limit structural damages due to this catastrophe. The last few decades have seen the development of a number of metal yielding passive control mechanisms to minimize this damage. Added Damping and Stiffness (ADAS), Triangular Added Damping and Stiffness (TADAS) and Buckling Restrained Brace (BRB) are the most commonly used metal yielding passive control systems. Recently, a pilot testing scheme was carried out on a newly developed metal yielding device known as a yielding shear panel device (YSPD) at the University of Queensland and the City University of Hong Kong (Chan, Albermani & Williams, 2009). YSPD is designed to exploit the shear deformation capacity of metallic plates to absorb earthquake energy. Finite element models have been developed to simulate the load-deformation behaviour of YSPD. Results obtained from the developed finite element (FE) models are compared against available test results. The current paper presents a review on metal yielding devices with special focus on the suitability of YSPD in earthquake damage mitigation.

Key words: ADAS, BRB, Earthquake, metal yielding device, passive energy dissipation, TADAS, YSPD.

SEISMIC PERFORMANCE OF COLD FORMED STEEL STRAP BRACED WALLS

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Abstract: The use of cold formed steel structures (CFS) has grown dramatically in recent years all over the world but with greater rate of growth in non-seismic regions. Adequate bracing and brace performance is of paramount importance to improve the acceptability of these systems in earthquake prone regions. In this study, the performance of four different configurations of X-braced cold-formed steel shear walls is evaluated by testing full scale walls of 2.4 m × 2.4 m under cyclic loading. Of particular interest are the specimens maximum lateral load capacity and the load-deformation behaviour. The study also looks at the failure modes of the system and investigates the main factors contributing to the ductile response of the CFS walls in order to suggest improvements so that the shear steel walls respond plastically with a significant drift and without any risk of brittle failure such as connection failure or stud buckling. The walls tested have different number of strap elements with different angles. The study shows that the performance of this kind of CFS lateral resistant system under cyclic loads is satisfactory; and can be considered as a reliable system for current-in-use industrial housing especially in regions with low to medium seismic activity.

Key words: Cold-Formed Steel, Light Steel Frame, Strap braced, Lateral Performance.

SEISMIC PERFORMANCE OF COLD FORMED STEEL WALLS BRACED BY FIBRE-CEMENT BOARDS

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Abstract: This paper presents an experimental study of cold formed steel frames sheathed by fibre-cement boards under cyclic lateral loading. Three full scale fibre-cement shear walls of 2.4m × 2.4m and one 2.4m × 1.2m wall were tested. Of particular interests are the specimens maximum lateral load capacity and the load-deformation behaviour. The study also looks at the failure modes of the systems and investigates the main factors contributing to the ductile response of the CFS walls in order to suggest improvements so that the shear fibre-cement board steel walls respond plastically with a significant drift and without any risk of brittle failure such as connection failure or fibre-cement board tearing. Double sided and single sided fibre-cement sheathed walls with different stud frame configurations were tested. The study shows that the performance of this kind of CFS lateral resistant system under cyclic loads is satisfactory; and can be considered as a reliable system even in high seismic regions.

Key words: Cold-Formed Steel, Light Steel Frame, Fibre-cement board, Lateral Performance.

CAPACITY OF COLD FORMED STEEL WALLS SUBJECTED TO LATERAL CYCLIC LOADING

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Abstract: The purpose of this study is to complete the previous research publication of the third author on the subject of cold-formed steel structures. This research aims to evaluate the lateral response of cold-formed steel walls in order to improve the lateral load capacity. Cold-formed steel walls were tested with different wall configurations braced particularly with steel sheathing. The conducted experiments were based on cyclic loading in lieu of actual earthquake loading. Within a specially made testing rig cyclic loading method comprised load exertion on the positive displacement followed by a reverse direction reaching towards the negative displacement. For each wall, the cycles would keep repeating as the displacements increased further until both negative and positive maximum displacements were reached while the progress of load capacity was recorded and plotted into a hysteresis graph. From the conducted tests, the structural elements such as double noggings, double end studs and additional reinforcement of screws at corners were found to be the dominant factors that improved the lateral strength of the walls. Despite the slight contribution to the lateral load capacity value, the wall with the smallest size of fastener spacing seemed to sustain the lateral load capacity throughout the cycles until the damage was reached. The understanding obtained from this research of the function and the impact of individual elements on the behaviour of the cold-formed steel walls can help improving the capacity and the ductility of the system.

Key words: Cold-formed steel, steel wall sheathing, lateral load, capacity, cyclic loading.

QUANTIFYING AXIAL DEFORMATIONS OF COLUMNS USING VIBRATION CHARACTERISTICS

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Abstract: Column elements at a certain level in building are subjected to loads from different tributary areas. Consequently, differential axial deformation among these elements occurs. Adverse effects of differential axial deformation increase with building height and geometric complexity. Vibrating wire, electronic strain and external mechanical strain gauges are used to measure the axial deformations to take adequate provisions to mitigate the adverse effects. These gauges require deploying in or on the elements during their construction in order to acquire necessary measurements continuously. The use of these gauges is therefore inconvenient and uneconomical. This highlights the need for a method to quantify the axial deformation using ambient measurements. This paper proposes a comprehensive vibration based method. The unique capabilities of the proposed method present through an illustrative example.

Key words: Axial Deformation. Column Elements Vibration Characteristics, Dynamic Stiffness Matrix, Finite Element Technique.

QUANTIFYING AXIAL DEFORMATIONS OF CORE SHEAR WALLS USING MODAL PARAMETERS

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Abstract: Differential axial deformation between column elements and shear wall elements of cores increase with building height and geometric complexity. Adverse effects due to the differential axial deformation reduce building performance and life time serviceability. Quantifying axial deformations using ambient measurements from vibrating wire, external mechanical and electronic strain gauges in order to acquire adequate provisions to mitigate the adverse effects is well established method. However, these gauges require installing in or on elements to acquire continuous measurements and hence use of these gauges is uneconomical and inconvenient. This motivates to develop a method to quantify the axial deformations. This paper proposes an

innovative method based on modal parameters to quantify axial deformations of shear wall elements in cores of buildings. Capabilities of the method are presented though an illustrative example.

Key words: Axial Deformation. Shear Wall Elements in Cores, Modal Parameters, Dynamic Stiffness Matrix, Finite Element Technique.

DRIVEABILITY OF COMPOSITE PILES

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Abstract: Deep foundation has historically involved the use of traditional materials such as concrete, steel and timber. However, these materials suffered from strength degradation and its repair cost is significant especially if installed in harsh marine environment. A relatively new trend in piling industry is to use composites as substitute material. Composites present a novel solution without most of the traditional materials' shortcomings. The basic advantages of composites among other construction materials include lightweight, high strength-to-weight ratio, corrosion resistance, chemical and environmental resistance, and low maintenance cost. Apart from the mentioned advantages, composite materials face impediments since they do not have a long track record of use in piling system. To partially address the aforementioned barrier, this paper presents information on the driveability of composite piles which is one of the first steps toward understanding its behaviour during driving. Additionally, experimental impact test result conducted by the authors on fibre reinforced polymers (FRP) hollow pile is also discussed in this study. Result from the impact test on laminate confirms that longitudinal specimen exhibited higher energy absorption capacity compared to the transverse specimens. The performed axial impact test on pultruded section revealed that degradation of stiffness increases with increasing incident energies and impact cycles. Generally, literature showed limited information on full-scale driving test and needed field tests to carefully assess and verify the driving performance of the composite piles to be used in developing reliable design procedures.

Key words: Composite piles, pile driving, fibre reinforced polymers (FRP), impact behaviour.

THE EFFECTS OF FIBRE WRAPS ON THE FLEXURAL BEHAVIOUR OF GLULAM COMPOSITE SANDWICH BEAMS

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Abstract: A novel composite sandwich structure made up of glass fibre composite skins and modified phenolic core material has been developed for civil engineering applications. The satisfactory performance of this composite sandwich material as structural panels in several building and residential projects has shown the possibility of using this material in the development of structural beams. As these composite sandwich panels are manufactured in limited thicknesses, the structural beam section could be attained by gluing a number of sandwich panels together in the flatwise or edgewise positions. An experimental study of the flexural behaviour of the glue-laminated (glulam) composite sandwich beams with different orientations of sandwich laminations was evaluated to determine the most effective use of this composite material for structural beam applications. The effects of wrapping the glulam sandwich beams with one-layer of tri-axial glass fibres on the flexural behaviour were also examined.

The glulam sandwich beams with edgewise laminations showed better structural performance compared to the beams with flatwise laminations due to the introduction of the vertical fibre composite skins. The glulam beams with edgewise sandwich laminations failed with 25% higher bending strength and almost similar bending stiffness than beams with flatwise laminations. The glulam sandwich beams with fibre wraps behaved slightly stiffer compared to the sandwich beams without wraps. In addition, the presence of fibre wraps prevented the immediate failure of the glulam beams which resulted in a higher strength and more ductile failure behaviour.

Key words: Sandwich structures, glulam beams, fibre composites, fibre wraps, flexure.

INVESTIGATION OF HYBRIDIZED POLYURETHANE, GLASS FIBRE REINFORCED CEMENT AND STEEL LAMINATE IN STRUCTURAL FLOOR PLATE SYSTEMS

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Abstract: Sandwich components have emerged as light weight, efficient, economical, recyclable and reusable building systems which provide an alternative to both stiffened steel and reinforced concrete. These components are made of composite materials in which two metal face plates or Glassfibre Reinforced Cement (GRC) layers are bonded and form a sandwich with light weight compact polyurethane (PU) elastomer core. Existing examples of product applications are light weight sandwich panels for walls and roofs, Sandwich Plate System (SPS) for stadia, arena terraces, naval construction and bridges and Domeshell structures for dome type structures. Limited research has been conducted to investigate performance characteristics and applicability of sandwich or hybrid materials as structural flooring systems. Performance characteristics of Hybrid Floor Plate Systems comprising GRC, PU and Steel have not been adequately investigated and quantified. Therefore there is very little knowledge and design guidance for their application in commercial and residential buildings. This research investigates performance characteristics steel, PU and GRC in Hybrid Floor Plate Systems (HFPS) and develops a new floor system with appropriate design guide lines.

Key words: Sandwich panel, Experimental testing, FEM

INVESTIGATION OF THE DUCTILITY OF RC BEAMS: BASED ON AS3600 DESIGN

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Abstract: Reinforced concrete beams are likely to experience high bending moment when subjected to ultimate loading. Curvature ductility is a well accepted index of expressing the ability of the structure to sustain high load intensities. The member ductility – rotational ductility in case of bending moment - arises from section ductility e.g. curvature ductility. Issuing of the new version of AS3600 and emergence of 500N rebar steel have introduced new possibilities in RC member design in Australia. Concerns on 500N rebar steel ductility due to its lower elongation strain compared to other ductile steel require a more careful focus on the design process. This study is an attempt to quantify the section ductility of RC beams designed based on the latest Australian code using 500N rebar steel. Different section dimensions as well as various concrete compressive strengths were used in the study. The nonlinear moment-curvature analysis carried out for designed cases. As expected heavily reinforced sections exhibit lower ductility comparing to those reinforced lightly. In addition increasing the section height and the concrete compressive strength have positive effects on curvature ductility. It is found that the curvature ductility for considered cases ranges between 2.0 and 12.0. It seems that for small sections, the curvature ductility is low and is less than predicted. Generally speaking, more research is necessary in order to verify the ability of 500N rebar steel in providing reasonable ductility required for load redistribution and other requirements in limit state design.

Key words: RC beams, curvature, ductility, design code, load combinations.

A MATERIAL MODEL FOR FLEXURAL CRACK SIMULATION IN REINFORCED CONCRETE ELEMENTS USING ABAQUS

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Abstract: This paper presents a material model to simulate load induced cracking in Reinforced Concrete (RC) elements in ABAQUS finite element package. Two numerical material models are used and combined to simulate complete stress-strain behaviour of concrete under compression and tension including damage properties. Both numerical techniques used in the present material model are capable of developing the stress-strain curves including strain softening regimes only using ultimate compressive strength of concrete, which is easily and practically obtainable for many of the existing RC structures or those to be built. Therefore, the method proposed in this paper is valuable in assessing existing RC structures in the absence of more detailed test results. The numerical models are slightly modified from the original versions to be comparable with the damaged plasticity model used in ABAQUS. The model is validated using different experiment results for RC beam elements presented in the literature. The results indicate a good agreement with load vs. displacement curve and observed crack patterns.

Key words: Reinforced concrete, crack, tension stiffening, compressive stress-strain relationship.

NONLINEAR NUMERICAL INVESTIGATION OF BUCKLE PROPAGATION IN SUBSEA PIPELINES

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Abstract: When a cylindrical shell buckles under hydrostatic pressure, the buckling propagates along the pipe, developing a post buckling phenomena which causes a progressive structural failure. The existing design approaches are conservative giving approximately 1.5-2 times the collapse values, therefore finding the real values can lead to the optimum design.

In this research, numerical modelling of buckling propagation has been investigated. A finite element modelling of the pipe has been conducted by ANSYS software invoking nonlinearities both in material and geometry. The finite element models are based on the data from the experiments conducted at the Structures Laboratory of The University of Queensland. The results obtained from the nonlinear modelling are in a reasonable agreement with those achieved in the experiments.

Key words: Buckling propagation, Nonlinear

IMPLICATION OF POLICY RESTRICTION ON NON-MOTORIZED PUBLIC TRANSPORT PERFORMANCE IN DHAKA: AN ANALYTICAL DISCOURSE

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Abstract: Non-motorised public transport (NMPT) involves cycle-powered vehicles known as pedicabs or rickshaws that carry several passengers and a small amount of goods; and provide flexible hail-and-ride services. The role contribution of rickshaw in resolving urban transport issues of mobility, congestion, safety and environmental aspects are becoming increasingly important in developing cities. This is particularly applicable for NMPT dominant cities such as Dhaka, Delhi and Surabaya. But there has been little attention and recognition towards NMPT, its continued significance and the integration necessity in the transport system. This is primarily demonstrated through negative policies towards rickshaw operation and management; resulting in increased sufferings of common people and reduced equity in access to transport. This paper attempts to quantitatively analyse the accessibility and connectivity effect of rickshaw restrictive policy measures on transport network with Dhaka, the most NMPT dominant city in the world as a case study. VISUM, a strategic network modelling tool is used as platform for analysis. This investigation is preceded by brief portrayal of the current role

significance of rickshaw and contradictory policy orientation from decision makers to set the scene for impact analysis in due context. The results clearly indicated increase in travel distance, subsequent loss of travel time and disconnectivity in part of the network as an after effect of such restrictive policy. This in turn is creating undue travel disadvantage for a large market segments, making the overall transport system of Dhaka imbalanced and unsustainable.

Key words: Policy restriction, non-motorized public transport, Dhaka, accessibility, connectivity.

PROSPECTIVE BUS RAPID TRANSIT SCENARIOS FOR PILOT CORRIDOR IN DHAKA

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Abstract: Dhaka doesn't have a mature transport system. Lacking in institutional arrangements, policy and planning, and law enforcement, the transport system operates has developed ad hoc and is situationally problematic. Absence of proper coordination between modes, poor public transport system, inadequate pedestrian facilities, and environmental degradation justify full consideration of Bus Rapid Transit (BRT) in Dhaka. BRT centres on sustainable transport principles. BRT is a system, which is capable to mitigate Dhaka's transport problem if properly planned. In Strategic transport plan of Dhaka three BRT transport corridor has been proposed and BRT pre-feasibility study came up with one pilot corridor for early implementation of BRT. This paper first reviews international best practices then explores various BRT system packages and evaluates the suitability of these BRT packages by analyzing current bus service condition and physical and geometric configuration along the BRT pilot corridor. It concludes by proposing some BRT scenarios, which can be considered for further evaluation with respect to speed, delay, travel time and environmental pollution.

Key words: Bus Rapid Transit, Bus Lane, Bus Way, Bus Priority, Bus Only Highway, Bangladesh

TRAVEL TIME RELIABILITY MODELS FOR URBAN NETWORKS: A REVIEW OF EVIDENCE

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Abstract: Dealing with heavy traffic congestion during peak periods has become a common challenge in urban areas. Travellers are accustomed to daily congestion and usually plan for it by changing either the route or the trip start time. However, unexpected occurrences that impose significant changes of travel time from day to day are sources of significant costs.

Due to the potential of travel time information to reduce congestion, both expected and unexpected, travel time reliability (TTR) has now become one of the most important indicators of transportation performance. This paper addresses definitions and measures of TTR from different viewpoints, explores the latest findings related to the causes of travel time variability (TTV) and uncertainty on urban networks. Both recurrent and non-recurrent congestion are dealt with separately. These causes are categorized in seven major groups. The relative importance of each of these factors is discussed and the latest TTR models are reviewed. Future research directions are also discussed.

Key words: travel time; travel time reliability; traffic incidents; recurrent congestion; non-recurrent congestion.

ESTIMATING THE LATENT DEMAND FOR RAIL TRANSIT: A CASE STUDY IN PERTH, WESTERN AUSTRALIA

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Abstract: This paper presents a study on estimating the latent demand for rail transit in Australian context. Based on travel mode-choice modelling, a two-stage analysis approach is proposed, namely market population identification and mode share estimation. A case study is conducted on Midland-Fremantle rail transit corridor in Perth, Western Australia. The required data mainly include journey-to-work trip data from Australian Bureau of Statistics Census 2006 and work-purpose mode-choice model in Perth Strategic Transport Evaluation Model. The market profile is analysed, such as catchment areas, market population, mode shares, mode specific trip distributions and average trip distances. A numerical simulation is performed to test the sensitivity of the transit ridership to the change of fuel price. A corridor-level transit demand function of fuel price is thus obtained and its characteristics of elasticity are discussed. This study explores a viable approach to developing a decision-support tool for the assessment of short-term impacts of policy and operational adjustments on corridor-level demand for rail transit.

Key words: Rail transit, demand estimation, travel mode choice, ridership elasticity, fuel price.

THE BRISBANE CORDON SCHEME: PART A - PRELIMINARY INVESTIGATION

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Abstract: It could be said that road congestion is one of the most significant problems within any modern metropolitan area. For several decades now, around the globe, congestion in metropolitan areas has been worsening for two main reasons. Firstly, road congestion has significantly increased due to a higher demand for road space because of growth in populations, economic activity and incomes (Hensher & Puckett, 2007). This factor, in conjunction with a significant lack of investment in new road and

public transport infrastructure, has seen the road network capacities of cities exceeded by traffic volumes and thus, resulted in increased traffic congestion. This relentless increase in road traffic congestion has resulted in a dramatic increase in costs for both the road users and ultimately the metropolitan areas concerned (Bureau of Transport and Regional Economics, 2007). In response to this issue, several major cities around the world, including London, Stockholm and Singapore, have implemented congestion-charging schemes in order to combat the effects of road congestion. A congestion-charging scheme provides a mechanism for regulating traffic flows into the congested areas of a city, whilst simultaneously generating public revenue that can be used to improve both the public transport and road networks of the region. The aim of this paper was to assess the concept of congestion-charging, whilst reflecting on the experiences of various cities that have already implemented such systems. The findings from this paper have been used to inform the design of a congestion-charging scheme for the city of Brisbane in Australia in a supplementary study (Whitehead, Bunker, & Chung, 2011). The first section of this paper examines the background to road congestion; the theory behind different congestion-charging schemes; and the various technologies involved with the concept. The second section of this paper details the experiences, in relation to implementing a congestion-charging scheme, from the city of Stockholm in Sweden. This research has been crucial in forming a list of recommendations and lessons learnt for the design of a congestion-charging scheme in Australia. It is these recommendations that directly inform the proposed design of the Brisbane Cordon Scheme detailed in Whitehead et al. (2011).

Key words: Congestion Charging, Road Pricing, Tolls, Modelling

THE BRISBANE CORDON SCHEME: PART B - INVESTIGATION INTO FEASIBILITY AND EFFECTS

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Abstract: As detailed in Whitehead, Bunker and Chung (2011), a congestion-charging scheme provides a mechanism to combat congestion whilst simultaneously generating revenue to improve both the road and public transport networks. The aim of this paper is to assess the feasibility of implementing a congestion-charging scheme in the city of Brisbane in Australia and determine the potential effects of this initiative. In order to so, a congestion-charging scheme was designed for Brisbane and modelled using the Brisbane Strategic Transport Model with a base line year of 2026. This paper argues that the implementation of this initiative would prove to be effective in reducing the cities road congestion and increasing the overall sustainability of the region.

Key words: Congestion Charging, Road Pricing, Tolls, Modelling, Brisbane, Australia.

SUBTHEME 4:

SMART AND INTELLIGENT SYSTEMS

There are ten papers in this subtheme covering the disciplines of Materials Engineering, Mechanical Engineering, Asset Management, Communications, and Medical Engineering. The papers in this subtheme address sustainability and wellbeing by improving asset manager's ability to remotely monitor important structures such as bridges with Fibre Bragg grating sensors and Acoustic Emission sensors, adding to our knowledge of alloy materials, developing innovative road safety barriers, promoting lean initiatives in manufacturing to reduce waste and increase profitability, advancing technology in communications, developing new materials for the reconstruction of bones, and assessing and resolving cartilage degeneration:

The first paper in this subtheme notes that vertical displacements in bridges are a very important parameter for assessing the performance of the structure (although difficult to measure), and presents a review and preliminary study of the use of Fibre Bragg grating sensors to measure the vertical displacement of bridges in real time.

The second paper provides a review of the opportunities and challenges regarding the Acoustic Emissions technique for structural health monitoring, and reports on the findings of current research at QUT.

The third paper presents and discusses a numerical simulation of Acoustic Emissions in a thin plate as part of a preliminary study.

The next paper experimentally investigates and provides a discussion of the strain rate sensitivity and Hall-Petch relationship of microcrystalline and nanocrystalline magnesium-aluminium alloys.

The following paper investigates numerically and experimentally the mechanical performance of extruded polystyrene foams for use in an innovative road safety barrier that uses less water and reduces the rate of serious injuries in road accidents.

The subsequent paper in this subtheme uses a mathematical cost based model to assist manufacturers in identifying the most effective tools for minimising waste and other lean initiatives.

The next paper details a mathematical proof for slotted amplify-and-forward protocols in large cooperative communication systems.

The third last paper in this subtheme presents preparation, experimental test results, and a discussion of the properties of porous zirconia scaffolds modified with mesoporous bioglass coatings as a potential candidate for bone substitute.

The penultimate paper in this subtheme presents a preliminary characterisation of the surface of cartilage following exposure to synthetic lipids (both saturated and unsaturated) and demonstrates that there is potential to use synthetic lipids for resurfacing cartilage following degeneration or disease such as osteoarthritis.

The final paper in this subtheme is a review of optical non-destructive evaluation techniques, such as infrared and near infrared imaging, in the evaluation of articular cartilage integrity and finds that there is significant scope for further research in this field before these methods can be applied clinically for the assessment of dysfunctional articular joints.

USING FIBER BRAGG GRATING (FBG) SENSORS TO MEASURE VERTICAL DISPLACEMENTS OF BRIDGES -A PRELIMINARY STUDY

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Abstract: In many bridges, vertical displacements are the most relevant parameter for monitoring in the both short and long term. However, it is difficult to measure vertical displacements of bridges and yet they are among the most important indicators of structural behaviour. Therefore, it prompts a need to develop a simple, inexpensive and yet more practical method to measure vertical displacements of bridges. With the development of fiber-optics technologies, fiber Bragg grating (FBG) sensors have been widely used in structural health monitoring. The advantages of these sensors over the conventional sensors include multiplexing capabilities, high sample rate, small size and electro-magnetic interference (EMI) immunity. In this paper, methods of vertical displacement measurements of bridges are first reviewed. Then, FBG technology is briefly introduced including principle, sensing system, characteristics and different types of FBG sensors. Finally, the methodology of vertical displacement measurements using FBG sensors is presented and a trial test is described. It is concluded that using FBG sensors is feasible to measure vertical displacements of bridges. This method can be used to understand global behaviour of bridge's span and can further develop for structural health monitoring techniques such as damage detection.

Key words: Vertical displacement, structural health monitoring (SHM), bridge, Fiber Bragg Grating (FBG) sensors.

REVIEW: ACOUSTIC EMISSION TECHNIQUE - OPPORTUNITIES, CHALLENGES AND CURRENT WORK AT QUT

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Abstract: Acoustic emission (AE) is the phenomenon where high frequency stress waves are generated by rapid release of energy within a material by sources such as crack initiation or growth. AE technique involves recording these stress waves by means of sensors placed on the surface and subsequent analysis of the recorded signals to gather information such as the nature and location of the source. AE is one of the several non-destructive testing (NDT) techniques currently used for structural health monitoring (SHM) of civil, mechanical and aerospace structures. Some of its advantages include ability to provide continuous in-situ monitoring and high sensitivity to crack activity. Despite these advantages, several challenges still exist in successful application of AE monitoring. Accurate localization of AE sources, discrimination between genuine AE sources and spurious noise sources and damage quantification for severity assessment are some of the important issues in AE testing and will be discussed in this paper. Various data analysis and processing approaches will be applied to manage those issues.

Key words: Structural health monitoring, acoustic emissions, source localization, source discrimination, severity assessment.

SIMULATION OF INPLANE AND OUT OF PLANE AE SOURCE IN THIN PLATE

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Abstract: In most materials, short stress waves are generated during the process of plastic deformation, phase transformation, crack formation and crack growth. These phenomena are applied in acoustic emission (AE) for the detection of material defects in a wide spectrum of areas, ranging from nondestructive testing for the detection of materials defects to monitoring of microseismical activity. AE technique is also used for defect source identification and for failure detection. AE waves consist of P waves (primary/longitudinal waves), S waves (shear/transverse waves) and Rayleigh (surface) waves as well as reflected and diffracted waves. The propagation of AE waves in various modes has made the determination of source location difficult. In order to use acoustic emission technique for accurate identification of source, an understanding of wave propagation of the AE signals at various locations in a plate structure is essential. Furthermore, an understanding of wave propagation can also assist in sensor location for optimum detection of AE signals along with the characteristics of the source. In real life, as the AE signals radiate from the source it will result in stress waves. Unless the type of stress wave is known, it is very difficult to locate the source when using the classical propagation velocity equations. This paper describes the simulation of AE waves to identify the source location and its characteristics in steel plate as well as the wave modes. The finite element analysis (FEA) is used for the numerical simulation of wave propagation in thin plate. By knowing the type of wave generated, it is possible to apply the appropriate wave equations to determine the location of the source. For a single plate structure, the results show that the simulation algorithm is effective to simulate different stress waves.

Key words: Acoustic Emission, wave propagation, lamb wave.

HALL-PETCH RELATIONSHIP AND STRAIN RATE SENSITIVITY OF NANOCRYSTALLINE MG - 5WT% AL ALLOY

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Abstract: This study investigated the grain size dependence of mechanical properties and deformation mechanisms of microcrystalline (*mc*) and nanocrystalline (*nc*: grain size below 100 nm) Mg-5wt% Al alloys. The Hall-Petch relationship was investigated by both instrumented indentation tests and compression tests. The test results from the indentation tests and compression tests match well with each other. The breakdown of Hall-Petch relationship and the elevated strain rate sensitivity (SRS) of present Mg-5wt% Al alloys when the grain size was reduced below 58nm indicated the more significant role of GB mediated mechanisms in plastic deformation process. However, the relatively smaller SRS values compared to GB sliding and coble creep process suggested the plastic deformation in the current study is still dislocation mediated mechanism dominant.

Key words: nanocrystalline Mg alloy; Hall-Petch relationship; strain rate sensitivity, deformation mechanism.

TESTING AND SIMULATION OF EXTRUDED POLYSTYRENE FOAM AT LOW TO MODERATE STRAIN RATES

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Abstract: This paper presents a study into the behaviour of extruded polystyrene foam at low strain rates. The foam is being studied in order assess its potential for use as part of a new innovative design of portable road safety barrier the aim to consume less water and reduce rates of serious injury. The foam was tested at a range of low strain rates, with the stress and strain behaviour of the foam specimens being recorded. The energy absorption capabilities of the foam were assessed as well as the response of the foam to multiple loadings. The experimental data was then used to create a material model of the foam for use in the explicit finite element solver LS-DYNA. Simulations were carried out using the material model which showed excellent correlation between the numerical material model and the experimental data.

Key words: Energy absorption, polymeric foams, LS-DYNA, Fu-Chang

MAXIMIZING THE MANUFACTURER PERFORMANCE VALUE THROUGH LEAN INITIATIVES USING COST BASED MODEL

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Abstract: Numerous tools and techniques have been developed to eliminate or reduce waste and carry out lean concepts in the manufacturing environment. However, appropriate lean tools need to be selected and implemented in order to fulfil the manufacturer needs within their budgetary constraints. As a result, it is important to identify manufacturer needs and implement only those tools, which contribute maximum benefit to their needs. In this research a mathematical model is proposed for maximising the perceived value of manufacturer needs and developed a step-by-step methodology to select best performance metrics along with appropriate lean strategies within the budgetary constraints. With the help of a case study, the proposed model and method have been demonstrated.

Key words: Lean manufacturing, manufacturing performance metrics, lean strategies, decision making, and optimization.

ON THE EMPIRICAL EIGENVALUE DISTRIBUTION OF SLOTTED AMPLIFY-AND-FORWARD RELAYING PROTOCOL MODEL

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Abstract: In this paper we consider the case of large cooperative communication systems where terminals use the protocol known as slotted amplify-and-forward protocol to aid the source in its transmission. Using the perturbation expansion methods of resolvents and large deviation techniques we obtain an expression for the Stieltjes transform of the asymptotic eigenvalue distribution of a sample covariance random matrix of the type $\mathbf{HH}^{\dagger}$ where **H** is the channel matrix of the transmission model for the transmission protocol we consider. We prove that the resulting expression is similar to the Stieltjes transform in its quadratic equation form for the Marcenko-Pastur distribution.

Key words: cooperative communication, amplify-and-forward, resolvent, Stieltjes transform

POROUS ZIRCONIA SCAFFOLD MODIFIED WITH MESOPOROUS BIOGLASS COATING

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Abstract: Porous yttria-stabilized zirconia (YSZ) has been regarded as a potential candidate for bone substitute as its high mechanical strength. However, porous YSZ bodies are biologically inert to bone tissue. It is therefore necessary to introduce bioactive coatings onto the walls of the porous structures to enhance the bioactivity. In this study, the porous zirconia scaffolds were prepared by infiltration of Acrylonitrile Butadiene Styrene (ABS) scaffolds with 3 mol% yttria stabilized zirconia slurry. After sintering, a method of sol-gel dip coating was involved to make coating layer of mesoporous bioglass (MBGs). The porous zirconia without the coating had high porosities of 60.1% to 63.8%, and most macropores were interconnected with pore sizes of 0.5-0.8mm. The porous zirconia had compressive strengths of 9.07-9.90MPa. Moreover, the average coating thickness was about 7μm. There is no significant change of compressive strength for the porous zirconia with mesoporous biogalss coating. The bone marrow stromal cell (BMSC) proliferation test showed both uncoated and coated zirconia scaffolds have good biocompatibility. The scanning electron microscope (SEM) micrographs and the

compositional analysis graphs demonstrated that after testing in the simulated body fluid (SBF) for 7 days, the apatite formation occurred on the coating surface. Thus, porous zirconia-based ceramics were modified with bioactive coating of mesoporous bioglass for potential biomedical applications.

Key words: scaffold, porous structure, mesoporous bioglass, yttria-stabilized zirconia (YSZ), Compressive strength.

PRELIMINARY CHARACTERISATION OF THE SURFACE OF CARTILAGE FOLLOWING EXPOSURE TO SATURATED AND UNSATURATED SYNTHETIC LIPIDS

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Abstract: Articular cartilage is covered by a microscopic structure known as surface amorphous layer. This surface structure is often the first victim of attack during cartilage degeneration, thereby resulting in a gross impairment in cartilage function such as lubrication and load bearing. We hypothesize that incubation of degraded cartilage in solutions of different species of synthetic surface active phospholipids (saturated and unsaturated species) can remodel this lost surface structure. To test this hypothesis, the structural configuration of the surface of articular cartilage was studied and characterised with the lipid filled surface amorphous layer intact using the AFM. The results were then compared with those obtained following a systematic removal (delipidization) and replacement (relipidization) of this layer. Our results show that the unsaturated surfactant partially restored the lost surface amorphous layer while the saturated surfactant specie settled on the surface due to its poor solubility in aqueous solution.

Key words: AFM, articular cartilage, surface amorphous layer, lubrication, load bearing, delipidization, relipidization

OPTICAL NON-DESTRUCTIVE EVALUATION OF ARTICULAR CARTILAGE INTEGRITY: A REVIEW

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Abstract: This paper reviews the current status of the application of optical non-destructive methods, particularly infrared (IR) and near infrared (NIR), in the evaluation of the physiological integrity of articular cartilage. It is concluded that a significant amount of work is still required in order to achieve specificity and clinical applicability of these methods in the assessment and treatment of dysfunctional articular joints.

Key words: Articular cartilage, near infrared (NIR), infrared (IR), spectroscopy.