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Colophon
In this my second year of office as president of ASA, it gives me great pleasure to welcome you to both Griffith University and also to the 2012 and 46th Annual Conference of the Architectural Science Association (ASA), formally known and still affectionately referred to as the Australia and New Zealand Architectural Science Association. (ANZAScA).

The themes for this year’s conference once again cover the broad spectrum of disciplines that contribute to architectural science including: architecture and the environment, Buildings and energy, Construction materials and technology, Design education and computing, Thermal comfort, lighting and acoustics, and Urban and landscape studies. This year the technical committee received and reviewed 84 abstracts, from which eventuated some 50 peer reviewed papers.

this year, as with most years, the conference has attracted professional and student delegates from countries other than Australia and New Zealand and along with the ‘local’ delegates, I make all of you most welcome to what is arguably, the most prestigious architectural science conference in the southern hemisphere. I also warmly welcome our keynote speaker Professor Marc Aurel Schnabel from The Chinese University of Hong Kong, to address the conference on the subject of Architectural Science Realities.

At last year’s annual general meeting the members expressed a desire for the conference to have an overseas venue for 2013 and in light of this, and reflecting the truly international status of the conference and organization, Professor Schnabel from The Chinese University of Hong Kong has kindly offered to host the 47th Annual Conference of the society.

I hope you enjoy the collegial atmosphere and scientific and cultural experience of this year’s Architectural Science Association and all being well, I look forward to welcoming all of you to the 2013 conference in Hong Kong.
Keynote Speaker
Professor Marc Aurel Schnabel
The Chinese University of Hong Kong

Architectural Science Realities: How to get in and out again

There is a need for educators, professionals, learners and clients to interact efficiently and effectively. However, this is not always possible due to the different knowledge background or complexity of the matter. In recent years, online interactions, multimedia, mobile computing and face-to-face interaction create blended communication environments to which some universities or professionals have reacted. Social networks, as instruments for communication, have provided a potentially fruitful operative base in architecture. These technologies transfer communication, leadership, democratic interaction, teamwork, social engagement and responsibility away from the instructors to the participants. Implementing social network enabled communication can move design beyond its conventional realm and enables stakeholders to develop architectural knowledge that is embedded into a community of experts with their expertise both online and offline.

Readily available technologies, such as a multi-touch table-top for design collaborations and communication tasks employing three-dimensional digitalized models offers users from various disciplines to communicate and share their ideas by manipulating the reference and their own input simultaneously by simply using intuitive gestures. Haptic and proprioceptive perception of tangible representations are perceived and understood more readily and such a system provides an increased potential to compensate for the low spatial cognition of its users.

For example, by employing a parametric model of an urban environment, it is possible to explore the influence of the urban form on the thermal comfort on micro scale of the street levels. The results are interactively presented in online media that allows architects, planners and stakeholder to make informed decisions on the impact on thermal comfort of their design. This method contributes to urban planning issues in quantifying the thermal comfort in specific urban environment.

While problem-based communication becomes and iterative and reflexive process these current ways of interaction have pedagogical implications that are empowering learners to collaborate and communicate differently by integrating a variety of skills, knowledge and social environments with a rich learning experience.
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Abstracts

46th ANZAScA conference
The evolution of a framework for Building Environmental Assessment (BEA) for green buildings in Saudi Arabia

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Sustainable development has become a significant worldwide concern, and Building Environment Assessment (BEA) for green building play an important role to achieve sustainability in buildings. In some countries, rating tools are been used, such as LEED in the US, BREEAM in the UK, and Green Star in Australia. However, Saudi Arabia is yet to develop these tools. A first step recently is the development of the new established council (the Saudi Green Building Council) in Saudi Arabia has the full responsibility to develop such tools.

This research investigates the environmental issues that could underpin such a tool and it discusses the evolution framework for developing a national rating tool for green buildings. The research has investigated the Saudi opinions in developing the new framework, and clarified the most important building applications, environmental scope of studies, and the most important key performance areas (KPA’s) in assessing the buildings in Saudi Arabia.

This research concludes that Saudi Arabia has a different priority in considering sustainability in buildings due to the differences in the country environment, location, economy, and community culture. Daily energy saving and water resources were equally the highest priority then any other key performance indicators (KPA’s). A more interesting result was preserving the social and cultural character was far more important than carbon dioxide emission reduction. In addition the research has provided an evolution framework including, weighting system for the KPA’s. Finally, this research includes recommendations for the development of a new BEA for Saudi Arabia.
In 1975, Jay Appleton theorised that certain spatio-environmental conditions engender feelings of safety and security by providing opportunities for outlook and seclusion. This proposition, which has since become known as prospect-refuge theory, has been widely debated in a range of fields and has found an enduring place in environmental psychology. It first became popular in architecture in 1991 when Grant Hildebrand demonstrated its relevance to Frank Lloyd Wright’s housing design. Hildebrand used this theory to argue that particular combinations of spatial qualities – including enclosure, light and view – are essential for a liveable space. While prospect-refuge theory has since been widely used to interpret a range of architects’ works, and to support many theories of design, only limited empirical evidence is available to substantiate the theory. This paper analyses thirty separate attempts, over a twenty-eight year period, to examine the validity of prospect-refuge theory. The paper is not concerned with the results of these tests, but rather with the methods that have been used, their characteristics, strengths and weaknesses. The purpose of this paper is to provide a comprehensive, critical foundation for future empirical or sociological studies of this important theory as it relates to architecture.
Net Zero Energy Buildings (NZEB) are currently an emerging performance target for sustainable commercial buildings. A central issue is how this target can be met either through the design of new buildings or retrofitting of existing buildings. From a review of the NZEB definitions it is argued a new conceptualisation is needed which maps specific carbon abatement emissions for the components of the total energy system. The NZEB approach is examined in four projects. It is argued that retrofitting is needed to achieve reductions in global impact in terms of CO2 but often the scope of work is beyond the owner’s capability, Hence, local, national and global ‘welfare’ (subsidies and incentives) are needed. Nation states in this study are responding differently to this welfare capacity by promoting or penalizing the NZEB building methodologies. More research is needed to assess the level of welfare needed to support NZEB and to limit the environmental impacts of commercial buildings in line with GHG abatement targets.
Significant Lines: Measuring and Representing Architecture for Computational Analysis

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Whenever a computational or mathematical analysis of architectural space or form is undertaken, a range of decisions must be made about how the building will be measured and what parts of the building will be included in that measure. Most often these decisions relate to which lines or data in a drawing, model or photograph of a building, are significant for analysis. Various different approaches to computational analysis, including space syntax and shape grammar, have evolved distinct answers for this question, but many other methods, including semantic analysis, fractal analysis and related applications of Zipf’s law and Van der Laan septaves, do not have a similarly consistent framework. The present paper is focused on these latter computational methods that measure the distribution of detail in a design. The paper analyses the philosophical foundations of measurement-based research, before describing a framework for decision making regarding which elements in an architectural image should be measured and why. This framework is demonstrated using a series of plans and elevations showing different levels of detail in the same building, but which, after analysis, produce different numerical measures.
Transformation of ‘urban grey pocket’ to ‘urban green pocket’ in Dhaka, Bangladesh

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Due to the increase in migration to Dhaka city every year, it is undergoing rapid growth in the area of urbanization and consequently the new settlements, housing development projects and slum areas are all adding to the environmental impact. Due to the elevated price and scarcity of land, the city is developing both vertically in the city centre and horizontally towards the northern outskirts. Unfortunately in most cases the application of proper urban planning and development regulations is not being effectuated. Both old and new developing areas often have left over or unplanned spaces, otherwise known as ‘urban grey pockets’, which are becoming a threat to the environment as well as the society. In this paper, the author aims to address this issue through the means of a case study and proposes several ideas that can be taken into consideration with regards to the implementation and improvement of sustainable design in order to take change of the current situation. If the current situation is to improve, the application of proper design guidelines and regulated standards is imperative.
Identifying substantive IEQ factors for efficient building management

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This study aims to develop a rational framework for prioritizing different aspects of Indoor Environmental Quality (IEQ) for the strategic management of IEQ in office buildings. Based on the Post Occupancy Evaluation survey database from the Center for the Built Environment (CBE), a two-dimensional evaluation of various IEQ factors was conducted by (1) estimating their strength of relationship with overall workspace satisfaction as an importance index, and (2) measuring Actual Percentage of Dissatisfied (APD) as a performance index. A Substantiveness Index (SI) was derived from this analysis and it led to a three-way classification of the 15 IEQ factors in CBE’s survey questionnaire: Serious (Sound privacy), Of concern (Temperature, Amount of space, Noise level, Visual privacy and Air quality), and Trivial (Colours & textures, Adjustability of furniture, Comfort of furnishing, Visual comfort, Workspace cleanliness, Ease of interaction, Amount of light, Building maintenance and Building cleanliness).
Reflections on a student research-led design project involving children, climate change and landscape architecture

Susan J. Wake, (1), Jiye Cha, Lucia Cha (1)
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This paper is centred on knowledge building within research and design as a layered and collaborative approach. It develops a small case study of the learning journey of an undergraduate landscape architecture student and her supervisor through a research project that itself is about a process of collaborative learning through design with children (co-design). In turn the design project developed a concept for a hypothetical educational park focused on positive learning about climate change management within communities. The paper reflects on the project as an exploration of the education and environmental stewardship responsibilities of the practice of landscape architecture as centred on community outreach, especially children. The focus of the project was on design as a participatory and iterative process that engages people positively in understanding climate change and how it will change the way they live. Combined with a discussion of the supervisory process the paper provides an excellent example of knowledge building for all participants, which is grounded in theory and centred on practice.
The licensed building practitioner scheme: another step in the New Zealand leaking building battle

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The long-term proposal to license building practitioners, a reality from 1st March 2012, marks a significant retreat from the strong pioneering tradition of self-help building that historically has been a significant element in small-scale construction within New Zealand. The Licensed Building Practitioner’s Scheme (LBP) is another government initiative prompted by criticism of the systemic deficiencies within the NZ building industry by the 2002 Hunn Report. Its implementation restricts most design and construction of residential buildings to licensed personnel. The Government views the Licensed Building Practitioners scheme as part of an ongoing process to increase trade skill levels and building quality within the industry. It is also part of a process to shift responsibility for building oversight from the public to private industry, and hence lessen the financial burden to the New Zealand tax and ratepayer from poor supervision and decision making practices on the part of local government.

This paper will provide a brief history of the controversy surrounding building under performance. It will examine the role proposed for the Licensed Building Practitioner and the role LBP’s will play within the building industry. Submissions on the merits of the scheme, made in response to a request for feedback to the Building Act Review in 2010, are examined, evaluated and compared to an industry survey completed six months after the scheme’s introduction in March of 2012. The paper supports the view that the transfer of responsibility, of which the LBP is a part, runs the risk of failure unless legislative and educational systems supporting the intended role have had time to coalesce and prove their effectiveness.
The potential to reduce the embodied energy in construction through the use of renewable materials

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The threat of dangerous levels of global warming demand that we significantly reduce carbon emissions over the coming decades. Globally, carbon emissions from all energy end-uses in buildings in 2004 were estimated to be 8.6 Gt CO₂ or almost one quarter of total CO₂ emissions (IPCC 2007). In Australia, nearly ten per cent of greenhouse gases come from the residential sector (DCCEE 2012). However, it is not merely the operation of the buildings that contributes to their CO₂ emissions, but the energy used over their entire life cycle. Research has demonstrated that the embodied energy of the construction materials used in a building can sometimes equal the operational energy over the building’s entire lifetime (Crawford 2011). Therefore the materials used in construction need to be carefully considered. Conventional building materials not only represent high levels of embodied energy but also use resources that are finite and are being depleted. Renewable building materials are those materials that can be regenerated quickly enough to remove the threat of depletion and in theory their production could be carbon-neutral. To assess the potential for renewable building materials to reduce the embodied energy content of residential construction, the embodied energy of a small residential building has been determined. Wherever possible, the conventional construction materials were then replaced by commercially-available renewable building materials. The embodied energy of the building was then recalculated. The analysis showed that the embodied energy of the building could be reduced from 7.5 GJ per m² to 5.4 GJ per m² i.e. by 28%. The commercial availability of renewable materials, however, was a limiting factor and indicated that the industry is not yet well positioned to embrace this strategy to reduce embodied energy of construction. While some conventional building materials could readily be replaced, in many instances a renewable substitute could not be found.
Heat wave risks and residential buildings

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The modelling of the global climate over the 21st century indicates various changes including sea level rise and an overall warming effect of between 1.4 and 5.8 °C. The local effects of these long term global changes are currently being considered. It is probable that more severe and frequent heat waves will pose an increasing risk to the occupants of buildings in Australia and regions around the world. Recent heat waves have caused significant morbidity and mortality as well as a range of disruptive effects in the urban environment. This paper reports on a research project that aims to determine possible design options for adapting residential buildings to more severe heat waves. The focus of the research is on particular residents who are the more vulnerable in the community in terms of both health and financial resources. The paper reviews past and future impacts of heat waves and available mechanisms for dealing with their effects. The paper concludes by suggesting a number of design options that can be considered to adapt dwellings to more severe heat wave conditions.
Minimising the Impact of Resource Consumption in the Design and Construction of Buildings

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This paper reports on the preliminary stages of a project entitled *Re-considering sustainable building and design: a cultural change approach*. In particular, it focuses on that part of the project which deals with minimisation of the impact of resource consumption in the design and construction of buildings. Previous research on the various aspects of resource use in construction is reviewed. The interrelated factors which are relevant to the project are described including the usage of raw materials, consumption of energy and water to manufacture building elements, greenhouse gas emissions and landfill disposal. Some case studies are examined which indicate possible means to improve performance in this area and a hierarchy of actions for the recycling of construction materials required is presented. This forms a framework to guide the research project in its aim of developing a clear pathway to minimise resource usage and waste reduction. It is likely that the comprehensive adoption of procedures and strategies to minimise the impact of resource construction will necessitate a change in the attitudes and culture of all stakeholders involved in the construction of buildings.
Influence of height-to-width ratio: Case study on mean radiant temperature for Netherlands buildings

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A significant increase of extreme summer heat waves in Central Europe is arising, which has a strong influence on the living quality of its people. Thermal comfort and micro climate around buildings become important issues in urban planning affecting everyone’s daily lives. The major meteorological parameters, such as air temperature, air humidity, wind direction, wind speed and radiation are used to describe thermal comfort. Hereby the most important two parameters are wind speed and Mean Radiant Temperature (Tmrt). Tmrt sums all short and long wave radiation fluxes and weights the directional components for each up or down. In this study, a radiation model SOLWEIG is used to simulate spatial variations of Tmrt, we compare SOLWEIG’s simulation results with real survey data of Rotterdam in order to test whether SOLWEIG is suitable for Netherlands urban areas or not. We select a typical clear summer day in the Netherlands by examining its meteorological feature and simulate the temperatures on a computerised and idealized urban model with variable street widths and same height. Finally we discuss the Tmrt simulation results of different urban settings by comparing different street-aspect ratios (height-to-width ratio) using the SOLWEIG modelling. Our findings contribute to urban planning issues in quantifying the thermal comfort in specific urban environment and allow architects and planners to make informed decisions on the impact on thermal comfort of their design decisions.
Sustainable development aims to achieve environmental and human well-being. However, the current models of sustainable development give emphasis to environmental, social and economic aspects. The role of people-environment relationship and measure of human well-being in sustainable development is still unexplored. Although Quality of life (QoL) intends to assess well-being, conventional QoL metrics do not include environmental features. By including environmental qualities, we have defined a new measure, environmental Quality of Life (QoLe), which encapsulates satisfaction obtained from environmental quality of a place. The model contains attributes related to environmental quality (objective attributes), perceived residential environmental quality (subjective attributes) and environmental attitude of people (moderating variable). This approach allows the examination of the people-environment relationship in a residential setting. The testing of the model involved field work in a sustainable community (the Ecovillage) in South East Queensland and in a control group (conventional housing) in a nearby suburb. The Ecovillage demonstrates a high level of environmental consideration in planning and design of the community. The Ecovillage residents exhibited Preservation (pro-environmental) attitudes and expressed high levels of satisfaction with the residential environmental quality. Whereas, the conventional suburb lacks sustainable features, most of the residents preferred a Utilization attitude and were relatively less satisfied with their neighbourhood features.
BOSSA - Buildings Occupants Survey System Australia

Candido, Christhina (1); de Dear, Richard (1); Thomas, Leena (2); Kim, Jungsoo (1); Parkinson, Thomas (1)
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Post Occupancy Evaluation (POE) is a process that allows designers, developers, owners, operators and tenants to identify dysfunctional building services and design features, and highlight successful design. Several POE questionnaires have been developed in various parts of the world, but probably the two best known are Building Use Studies (BUS) in the UK, and the Center for the Built Environment (CBE) in the USA. Currently, these are the only two officially accredited POE instruments within the NABERS Indoor Environment and Green Star Performance rating tools for commercial buildings. Unfortunately, the BUS and CBE questionnaires have evolved from UK and US office cultures and as a result, are less relevant to Australian building owners’ needs and the resultant databases are not accessible to Australian building science researchers. But perhaps the most significant shortcoming of these current generation of POE systems is that they are largely descriptive and are unable to specifically explain why a building’s scores look the way they do, because no objective indoor environmental quality (IEQ) instrumental measurements were recorded alongside the questionnaires. The Building Occupants Survey System Australia - BOSSA, will provide for the first time, a building performance evaluation process that will grow into an Australian database to be used to underpin an ongoing program of IEQ research specifically for Australian commercial buildings owners and occupants.
Building User Guides are intended to inform building occupants of the building systems within their workplace. They are created to describe and document all the necessary information pertaining to the buildings operation, maintenance, management and basic trouble shooting procedures. There is evidence to suggest that the Building User Guides are written at a level that is too technical and too difficult. This paper evaluates how easily building occupants are able to read Building User Guides that have been designed for use in green buildings (where they can contribute to their building sustainability rating). Twenty-three Building User Guides by a range of firms and writers were sampled from all over the country. Their readability level was assessed using the Simple Measure of Gobbledegook (SMOG) as a basic measure of readability, while a second measure, a word frequency program was used to assess the vocabulary needed to read current Building User Guides. A wide variation was found in the readability of these guides. This paper explores the reasons why some rated better than others and highlights their key features.
The Impacts of High Performance Glazing on Typical Light Timber Framed Houses in a New Zealand Winter

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This paper reports on a project which uses two full-scale, three-bedroom standard houses to identify the impact of changes in building elements and materials on indoor environmental quality. The lightweight, timber framed, stand-alone houses are characteristic of New Zealand construction, and meet the requirements for the current New Zealand Building Code in terms of materials and insulation. One of the houses served as the test case for the research and incorporated high performance argon-filled Low-E double glazing. The second house acted as a control, with identical design and location but built using standard construction practice including conventional double glazing. The paper details the impact of the Low E argon filled double glazing on internal temperature during a monitoring period which ran over the New Zealand winter. It compares results for this wintertime period to the results of previous testing of the same houses over the summertime period, and also examines results in relation to the short-term laboratory-predicted impacts of material thermal performance. Findings indicated that throughout the wintertime period, both houses performed similarly. In both cases the most notable issue was the high internal temperatures reached on cold sunny days. There were minor performance differences between the standard double glazing and the high performance glazing. The temperatures reached in the test house on cold sunny days were less extreme than in the control house, but overnight and early morning temperatures were lower with the high performance glazing. On cold overcast days there was negligible difference between the two double glazing types.
Cooling NZ: institutional drivers behind the growth in air-conditioning

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Cooling by air-conditioning in buildings has been claimed to be addictive to the occupants. But for every addict there is ‘pusher’ who has introduced and supplies the product. This paper examines the motives of the institutional pushers that promote air-conditioning in the built environment in New Zealand. Compared to many countries, New Zealand has lagged behind in the growth of air-conditioning in the built environment. This makes it an ideal place to observe how various institutions and organisations are either deliberately or unselfconsciously promoting cooling to a population that has, until recently, survived well without it. The paper does not address the air-conditioning industry, as it is self-evident that it will promote its own products. Instead it focuses on those institutions that may ultimately suffer from their own actions. Central government, local government, the electricity supply industry, the Green Building Council, the Property Council, the New Zealand Institute of Architects and others are all ‘pushing’ air-conditioning, even though some may not be aware of it. Behind this is the assumption that there is a never-ending supply of energy and that the narrow band of comfort resulting from air-conditioning is healthy, promotes productivity, reduces complaints, enhances architectural style and is energy efficient. This paper will review the role that each of these institutions plays in the promotion of air-conditioning and discusses the ultimate demise of any building that relies on an uninterrupted supply of grid supplied energy in order to remain habitable. This research into the understanding of how these institutions operate to promote air-conditioning may eventually assist in reversing the process.
Responsive shading and energy efficiency in office buildings: an Australian case study

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Solar radiation allowed to be transmitted to air-conditioned space through a building’s glazing can be a major contributor to the total annual energy requirement for cooling a building. Without the presence of a sufficient barrier to absorb or reflect the radiation transmitted through the glazing, significant resources are committed to providing air-conditioning and maintaining lighting levels. Shading acts as a barrier to solar radiation; however, for shading to further reduce energy demand by being responsive, it is required to be automated so that it modifies the amount of shading provided according to external conditions. The operational energy component of the building’s life cycle energy is to be examined for internal and external responsive venetians for a case study building. As part of this study the impact of venetian shading upon the sizing of the HVAC as well as the differences between temperate and sub-tropical climates is also assessed. Overall, the use of smaller HVAC systems in conjunction with external responsive venetian shading was shown to reduce the building’s annual operational primary energy by up to 27% in comparison to a static shading option. By examining the energy impacts of responsive shading, this study provides guidance for energy efficient building design.
An as-occupied life cycle energy assessment of a residential building

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A comprehensive analysis of the energy demand of a building over its entire life, based on actual operational energy data and a comprehensive analysis of both initial and recurring embodied energy, is extremely rare. To address this, the aim of this study was to analyse the total energy demand associated with a case study house, based on as-occupied building energy data. A hybrid embodied energy assessment approach was used to quantify initial and recurring embodied energy over a 50-year period, providing the most comprehensive assessment of embodied energy possible. The study showed that the total life cycle energy demand of the case study house was 10,612 GJ, or 36.4 GJ/m². Of this, operational energy was shown to account for 40%, initial embodied energy 37% and recurring embodied energy 22% of the total. This demonstrates that the energy embodied in buildings is much more significant than previously thought. With on-going building operational energy efficiency improvements this component of a building’s energy demand is likely to become even more important as is the need to utilise best-practice approaches for quantifying embodied energy.
Evaluating the suitability of the AccuRate engine for simulation of massive construction elements

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A common criticism of the Nationwide House Energy Rating Scheme (NatHERS) is the adequacy of the thermal assessment software; second generation AccuRate. Many argue that the software is not capable of accurately modelling the building envelope and therefore should not be used as a tool in mandatory regulation. In the ‘Rating’ mode of operation AccuRate has limited capabilities in terms of input and output due to its regulatory nature. However, at the heart of AccuRate is the computational engine Chenath, an hourly simulation engine which has been tested and validated. This paper presents a comparison of simulations of buildings with massive construction elements using Chenath (V2.26), EnergyPlus (with DesignBuilder as the user interface), and Ener-Win. The comparisons were conducted for; 1) a hypothetical test cell; 2) a constructed test cell, and 3) an occupied house, where the simulation results were also compared with measured data. The results show that simulations with Chenath using AccuRate as the interface, compare favourably with the other two simulation engines and measured data with acceptable CV(RMSE).
An Empirical Validation of the ‘AccuRate’ Software Envelope Model in an Australian Cool-temperate Climate

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In 2003, the Building Code of Australia introduced its first thermal performance requirements for residential buildings. It mandated a minimum performance rating of 4 Stars when assessed by approved rating methods. This requirement has been progressively increased to 5 Stars in 2006 and 6 Stars in 2010. While the introduction of a 4 Stars requirement had only a minor impact on construction practices, the move from 4 to 5 and then 5 to 6 Stars has forced considerable change, especially in the use of timber platform floors in cool-temperate climates. The adoption of the prescribed energy efficiency measures in the National Construction Code (previously known as the Building Code of Australia) raised concerns from industry and manufacturing groups, as to the accuracy of the simulation method when compared to the actual thermal performance of residential buildings. Both industry and government recognised the need to validate the National House Energy Rating’s (NatHERS) benchmark software ‘AccuRate’. The software ‘AccuRate’ has been developed over time by the CSIRO and has evolved from a design tool to a regulatory tool. As a result, the School of Architecture & Design and its research arm, the Centre for Sustainable Architecture with Wood, was asked to validate the ‘AccuRate’ HER software. The University of Tasmania, in collaboration with Forest and Wood Products Australia, the Australian Government, the CSIRO and industry, undertook the construction of three test buildings for the purpose of empirically validating the ‘AccuRate’ software in a cool temperate climate. The three test buildings followed standard residential construction practises and included an unenclosed-perimeter platform-floored building, an enclosed-perimeter platform-floored building and a concrete slab-on-ground floored building.

The process of design, construction, environmental measurement, detailed simulation and methods of statistical analysis are discussed briefly. Graphical analysis is used to illustrate the variations that occurred between the measured and simulated zone temperatures for each test building. The statistical analysis of the measured and simulated data indicated the need for further investigation of the ground, sub-floor, roof space, wind speed, infiltration, solar radiation and thermal mass algorithms. If the differences observed in this research were applied to full scale houses there may be a significant impact on the House Energy Star rating. The research identified the need for the continuous improvement and calibration of the AccuRate software.
Learning from ‘Earthship’ based on monitoring and thermal simulation

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This paper describes research which investigates the thermal performance of Earthship, an autonomous, earth-sheltered housing concept that claims to require no active heating or cooling systems despite extreme climatic conditions. This research aims to test these claims through monitoring and thermal simulations. The study involves monitoring the indoor conditions in an Earthship home in New Mexico USA and uses the measured data to calibrate a computer model used to simulate the thermal performance of the home. A second part of the study compares Earthship thermal performance located in a temperate climate in Australia with that of buildings incorporating different wall construction materials such as strawbale, rammed earth, and brick veneer. Results from both of these studies substantiate the claims. The effect of including a greenhouse, earth-berm, and internal wall material is also explored and quantified. The paper will conclude with a discussion of the scope for reducing home energy use through the use of Earthship design principles and construction methods and the viability for building these houses in the Australian suburbs.
Fifty two percent of the energy consumption in Chilean dwellings comes from space heating. The country depends by an 80% on fuel imports. An increase in energy prices and fuel supply problems have obligated Chile to consider cheaper forms of energy such as wood, affecting people’s health. The aim of this study is to reduce energy consumption and CO₂ emissions caused by space heating implementing the UK’s SAP methodology in Chilean dwellings. The measures consisted of increasing the airtightness, reducing the thermal bridging and implementing energy efficient building services. Based on the current Chilean Thermal Regulations, walls were improved by making their u-values more even compared to the ones in roof and floor. Zones 1 and 2 reduced energy up to 75% with savings in CO₂ emissions up to 21%, by adding external insulation, reducing thermal bridging and air permeability. In the case of zones 4 to 7, the maximum energy savings were up to 71% considering CO₂ emission reductions of 48%. These were achieved by implementing thermal envelope improvements and solar collectors. Zone 3 was recommended to improve the fabrics in complement to using electric wall panel heaters reducing energy by 43% and CO₂ emissions by 75%.
Retrofits to improve energy efficiency of existing buildings in the tertiary education sector - An investigation of current practice and implications

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Addressing energy efficiency in the existing building stock has been acknowledged as one of the most critical yet challenging aspects of reducing our environmental footprint on the ecosystem. This paper presents a case study of current standard practice in energy efficiency retrofit in Australia’s tertiary education sector. The analysis of energy performance encompasses that of the immediate retrofit as well as of the wider campus. The results suggest that although energy performance appears to have been improved, there is considerable scope for further improvement despite the complex variables. The findings’ hypothesis is that there may be significant benefits in establishing a retrofit standard or directive to improve energy efficiency in existing building for the construction industry at large.
Double Skin Façade system and Green Wall system are two façade techniques that have the potential to improve indoor thermal performance and reduce the energy consumption of a building. Studies have been done in both areas, but no research has been conducted in comparing the performance of Double Skin Façade and Green Wall, even though both façade techniques have been applied (mostly) in commercial building for years. This research compared the performance of a simple designed office building implementing Double Skin Façade and Green Wall respectively based on simulation results which are carried out using the simulation program EnergyPlus. The comparison focuses on cooling, heating, lighting, and total energy consumption of the building by implementing each façade technique on four orientations during summer design week and winter design week as well as the whole year. The results show that the building with Green Wall is potentially able to reduce more energy consumption and has better thermal performance than the building with Double Skin Façade under most scenarios.
A Simple-to-Use Calculator for determining the Total Solar Heat Gain of a Glazing System

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Architects and designers could readily use a quick and easy tool to determine the solar heat gains of their selected glazing systems for particular orientations, tilts and climate data. Speedy results under variable solar angles and degree of irradiance would be welcomed by most. Furthermore, a newly proposed program should utilise the outputs of existing glazing tools and their standard information, such as the use of U-values and Solar Heat Gain Coefficients (SHGC’s) as generated for numerous glazing configurations by the well-known program WINDOW 6.0 (LBNL, 2001). The results of this tool provide interior glass surface temperature and transmitted solar radiation which link into comfort analysis inputs required by the ASHRAE Thermal Comfort Tool –V2 (ASHRAE, 2011). This tool is a simple-to-use calculator providing the total solar heat gain of a glazing system exposed to various angles of solar incidence. Given basic climate (solar) data, as well as the orientation of the glazing under consideration the solar heat gain can be calculated. The calculation incorporates the Solar Heat Gain Coefficient function produced for the glazing system under various angles of solar incidence WINDOW 6.0 (LBNL, 2001). The significance of this work rests in providing an orientation-based heat transfer calculator through an easy-to-use tool (using Microsoft EXCEL) for user inputs of climate and Solar Heat Gain Coefficient (WINDOW-6) data. We address the factors to be considered such as solar position and the incident angles to the horizontal and the window surface, and the fact that the solar heat gain coefficient is a function of the angle of incidence. We also discuss the effect of the diffuse components of radiation from the sky and those from ground surface reflection, which require refinement of the calculation methods. The calculator is implemented in an Excel workbook allowing the user to input a dataset and immediately produce the resulting solar gain. We compare this calculated total solar heat gain with measurements from a test facility described elsewhere in this conference (Luther et.al., 2012).
Developing a facility for glass façade performance testing

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This research aims to investigate whether real spaces can support legitimate measurements on glazing energy and thermal comfort analysis. This paper presents the development of a research facility for doing this. It will test simple to complex glazing and shading systems in a real (occupied) interior office environment. The purpose of this research project is to compare measured results with those being simulated with existing software and to discover discrepancies between simulation and real measured results. What parameters characterize a glazing system, whether simple or complex? Can these parameters be used to predict the energy transfer and comfort in the space? One must begin with simple glazing systems and verify measured with readily known simulated results. It is, at present, very difficult to use geometric based software with thermal based software to predict the performance of complex glazing systems. However, if we can characterize glazing systems with a set of reliable measurements, we can provide the data necessary for predicting performance in a live space. Specifically, the Solar Heat Gain Coefficient (SHGC) is a variable parameter based upon solar incident angle to a glazing system and is intended to be measured in its integral components: solar transmittance and inward-flowing fraction (radiative/convective) heat gain. A new instrumental approach through variable surface coated heat flux meters is being investigated to provide the measurement of interior glazing surface radiative and convective heat gain. The results suggest that this instrumentation may support be a viable method of testing inward-flowing heat gains from the interior glass surface. The test set-up also considers the application of a well-known B&K 1221 Comfort Meter for determining thermal comfort responses in the ‘perimeter zone’ on the interior side of a façade. This work requires further investigation, but is intended to be used in conjunction with solar pyranometers measuring transmittance as well as the heat flux meter and surface temperature instrumentation.
Our world is going through an unprecedented energy crisis. The increasing global energy demand combined with declining energy resources have resulted in such crisis. Moreover, energy sector is also claimed to be one of the major contributors of climate change as 65% of world’s green house gas (GHG) emission is energy related. A huge share of this energy is consumed by the cities and buildings. Reducing energy consumption by the building sector as well as shifting to green energy sources have become one of the prime agendas to address both the issues of climate change and energy security. Several alternative buildings and neighbourhoods have been emerged in developed countries to address this issue. Unfortunately, even after the successful existence of such alternatives for more than a decade, to date these have not yet been very successful to create a market demand. This paper argues that developing countries are rather in a favourable position due to some particular contexts for being successful in the wider deployment of these alternatives. This paper, through an in-depth literature review and personal experiences of the author as an architect and a Dhaka city dweller, examines and presents the potentiality of energy-plus urban developments in the unique context of Dhaka, the capital of Bangladesh.
Energy use and related greenhouse gas emissions of buildings have a significant impact on the environment. To reduce energy consumption in buildings, it is important to understand the energy use occurring across the building life cycle. While previous studies have shown the significance of both the energy required for building operation as well as the energy embodied in initial building construction, an understanding of the total energy embodied in replacement materials over a building’s life is not as well developed. One of the key factors affecting this ‘recurring’ embodied energy is the service life of materials. The aim of this study was to determine what effect a variation in the service life of materials has on the life cycle energy demand associated with residential buildings. The building’s initial embodied energy, operational energy and recurrent embodied energy were calculated with material service life values based on average figures obtained from the literature. These values were then varied to reflect the extent of service life variability likely for a selection of the main building materials and the recurring embodied energy recalculated for each scenario. The results from this initial study indicate that the service life of materials can have a considerable effect on the total energy demand associated with a building over its life. This demonstrates the need for further clarity around the service life of materials and the importance of considering the durability of materials when designing and managing buildings for improved energy efficiency. Results from this study also suggest the importance of including the recurrent embodied energy of buildings in building life cycle energy analyses, which in this case represented between 19 and 30% of the life cycle energy of the building.
Double-skin façade (DSF) buildings regularly appear in popular architectural journals and claims are made that the buildings are either ‘sustainable’, ‘green’, ‘eco-friendly’ or ‘intelligent’. This results in myths about the performance of buildings that are perpetuated by designers eager to maintain a brand image. A literature review of research on the performance of DSFs reveals that the vast majority of the analysis is carried out by simulation methods and that there is a lack of empirical evidence obtained from monitored buildings. This paper will present some early findings from buildings with DSFs that are currently being monitored to assess the contribution of a DSF to reducing the building’s cooling load. It will also analyse the physics behind the common simulation models to examine whether the models are a reasonable representation of reality. Initial evidence indicates that DSFs in sub-tropical climates offer little energy savings and could even contribute to increasing cooling loads. It is argued that buildings that have implemented DSFs would be more energy efficient if the proportion of glass in the true elevations had been reduced rather than applying a DSF. It is the hypothesis of this paper that a DSF has become a way in which an excessively glazed building can maintain its transparent architectural image while still claiming to be ‘green’.
A holistic building life cycle energy assessment model

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Current energy assessments of residential building energy demand focus mainly on their operational aspect, notably in terms of space heating and cooling. The embodied energy of buildings and the transport energy consumption of their occupants are typically overlooked. Recent studies have shown that these two energy demands can represent more than half of the life cycle energy of a building over 50 years. This study presents a holistic method which takes into account energy requirements at the building scale, i.e. the embodied and operational energy of the building and its refurbishment, and at the city scale, i.e. the embodied energy of nearby infrastructures (roads, power lines, etc.) and the transport energy (direct and indirect) of its users. This method has been implemented through the development of a software tool which allows the rapid analysis of the life cycle energy demand of buildings at different scales. A case study, located near Melbourne, Australia, confirms that each of the embodied, operational and transport requirements are nearly equally important. Embodied and transport energy consumption represent on average 63% of the life cycle energy requirements. By integrating these three energy flows, the developed method and software tool provide building designers, planners and decision makers with a powerful means to effectively reduce the overall energy consumption and associated greenhouse gas emissions associated with residential buildings.
Thermal performance modelling: design strategies for improved thermal performance in selected NZ houses

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This study was a joint research project between Victoria University of Wellington’s School of Architecture and Design and the Wellington-based architectural practice Studio Pacific Architecture. It is a continuation of a previous study. The aim of the study was to determine the best methods of improving the thermal performance of new houses and to provide empirical evidence to back up the selection of any particular strategy. The thermal performance of nine Studio Pacific designed case study houses was modelled for three differing New Zealand locations. A range of construction and design variations were systematically assessed. Twenty combinations of insulation, glazing, and mass were modelled, as well as a number of variable design changes including orientation, level of glazing, shading, ventilation and more. This allowed the identification of the most effective options. Comparison of the houses enabled a better understanding of how different situations effect the effectiveness of design decisions. Options were evaluated not only on their effect on heating energy use, but also on their effect on passive performance. A series of recommendations for significantly improving the thermal performance of new house designs is made.
As an energy saving measure, part of an integrated response to mitigate climate change, the New Zealand Government raised the legal minimum requirements for the thermal performance of new homes. A carbon footprint provides a means to quantify the effect this action has had to reduce the impact our new homes have on the environment. To date however, no study in New Zealand has been published to ascertain the carbon footprint of this change. An investigation was made to quantify the additional embodied energy required to meet the new standard, and the resulting savings in electrical home space heating energy use. A desk top case study method was employed. A standard timber framed, three bedroom house design complying with the new thermal insulation standard was compared to the same design complying with the old standard over an operational life of 50 years. The test was conducted in New Zealand’s three climate zones with the aid of the ALF computer programme. The heating schedule employed within the home proved to be the most influential factor to both the carbon footprint size and the rate of environmental/carbon payback. The study showed that carbon payback for the increase in embodied energy could not be reached through heat energy savings within the 50 year operational life of the building, if a typical intermittent heating schedule was used powered through electricity generated by all renewable energy sources.
First Light: reflection on prefabrication

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This paper follows the progress of deploying a prefabricated building overseas. In the Solar Decathlon in 2011, a solar-powered house was designed, constructed in New Zealand and then shipped to the USA for a ten day long competition. The First Light House received a high ranking in the student competition, winning major awards. This paper builds upon two previous papers describing the design, procurement, construction, and onsite management of the prefabricated First Light housing system. It draws from and summarizes student work encapsulated within the university-funded project. The paper summarizes on-site issues with a building constructed off-site, and as a project gave all involved highly practical experience with the real, hands-on side of commercial practice.
Plantation timber forms an integral part of the future of timber industries, but in its production, significant quantities of timber is lost as waste in the form of plantation ‘thinnings’ (plantation thinnings are the sub-standard or poor quality trees that are removed prior to trees reaching full rotational age and have no to low commercial value). This paper reports on and promotes a more sustainable approach to the use of plantation timber and in particular the normally waste plantation ‘thinnings’. The holistic approach is achieved by developing methods not only for processing but also for the manufacture of products that utilize the plantation ‘thinnings’ for structural and architectural applications. More specifically, the paper reports on the development and testing of a number of concepts and structural and architectural prototypes and speculates on proposed applications in the construction and other industries. Topics covered include economic, social and environment benefits and the key focus - the potential uses as a sustainable construction material Plantation timbers offer social, financial and environmental benefits if correctly managed by governments and growers. By staggering timber harvesting, an endless supply of timber is possible. Environmental benefits include the reduction of dry-land salinity, reduction in greenhouse gasses and in aiding carbon sequestration.
Risk-assessment is seen as a tool for future refinement of performance-based building codes; the goal being to allocate consenting resources toward high-risk projects through risk-informed criteria. A literature review was conducted into building regulations, consenting processes and the role of professionals in a mixture of countries, states and cities internationally for elements of risk-based consenting with a purpose of providing comparison to the current situation in New Zealand. Broad similarities in regulations and codes were found, but a number of differences exist in approaches to consenting with differing levels of control, self-certification and private sector involvement. No jurisdiction has yet implemented a system of risk-based consenting, however a number of ad hoc elements of risk-assessment criteria for meeting codes found in each jurisdiction are identified. Many have made particular effort to simplify the process in cases of minor work. The roles and responsibilities of the authorities, building owners and building professionals are compared. Together the results provide a summary of international similarities and differences in the current status of risk-based consenting, building codes, roles of professionals and apportionment of liability.
Analyzing architectural space: identifying salient regions by computing 3D isovists

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Spatio-cognitive properties - including the capacity to evoke a sense of place or support wayfinding - are amongst the most important considerations in the design of large urban and architectural spaces. Both wayfinding and spatial identity rely on the capacity of a space to be noticeably distinct; a property that is called saliency. However, there are relatively few experimental techniques to identify locations that are rich in such visual properties and those that do exist were typically developed in the 1980s using only two-dimensional viewshed geometry. In contrast, this paper describes the use of 3D isovists to develop a salient region estimation technique for architectural and urban environments. The underlying method of saliency estimation is based on principal component analysis that is used to compare geometric properties of the areas surrounding a vantage point. Statistical summaries of the 3D isovists are compared in the principal component space to differentiate the monotonous regions from the ones that are more visually distinct. The experimental results reported in this paper are developed using a model of the Villa Savoye to demonstrate that 3D isovists can be used to determine the extent to which an environment supports a capacity for wayfinding. The paper makes two major contributions to architectural computational analysis; first, it demonstrates a consistent, stable 3D isovist method and second, it proposes a quantitative technique for detecting regions with strong visual characteristics.
Delivery of online digital feedback and assessment for design and engineering (architectural) students

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This paper concerns questions about whether blended learning (comprising the designed amalgamation of face-to-face and digital learning components) can be matched with the delivery of online feedback. In the architecture and engineering (architectural) field where there are complex design problems presented to students, design studios with instruction and feedback often one-on-one over the drawing board and feedback personalised to each student’s design, are there mechanisms for delivery of online feedback which suit this mode of learning and will improve students’ satisfaction with the quantity, frequency, timeliness and quality of feedback?

National Course Evaluation Questionnaire data highlights the need for improvement in feedback quality and delivery in University architecture and engineering fields, due to low overall satisfaction compared with other professional education fields. University and School student evaluation supported this feedback deficit. This paper looks at courses where modes of meaningful digital feedback (including audio feedback and online staff and peer feedback) have been introduced, and compares students’ satisfaction with feedback in these courses over five-year periods. The paper evaluates new ways of providing digital feedback in a resource-constrained University environment and proposes eight recommendations for the delivery of blended feedback and assessment.
The use of blended learning techniques is beneficial for design and engineering (architectural) students. In the case studies reviewed, a range of feedback and assessment was provided through blended learning, although none was provided solely utilising online elements. In considering the barriers to a more widespread adoption of digital or online feedback in the blended learning studio setting, speculation arose that one of the major limitations may be the reliance upon sessional staff for teaching, including marking and giving feedback. To determine the barriers (if any) to the adoption of blended learning assessment and online feedback by sessional staff we interviewed twenty-two sessional staff members from two adjacent Universities’ Architecture and Engineering Schools about their engagement with blended learning and providing online feedback. Sessional staff’s conceptions of their role in academia, and their beliefs about learning and teaching determined their practices in the studio and online. They were resource deficient, and unwilling to invest up-front in courses only taught once. Their constant juggling of commitments favoured the paid over the unpaid. We concluded that for universities to promote an effective e-learning strategy a re-conception of the teaching enterprise - from tool-led to staff development-led - is required.
Can utilising blended learning help achieve academic success for architecture and engineering students?

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Understanding how students utilise any element presented in teaching for their learning is important, particularly with increasing enrolments and resource limitations. This paper explores the ways in which design studies and architectural engineering students utilised digital learning elements alongside face-to-face teaching in a (so-called) blended learning environment when learning about the tectonics of designed construction. Methodologically, a case study of five successive iterations of one construction course taught from 2006-2010 was examined. The analytics which sit behind any Learning Management System (now ubiquitous in Universities) were harnessed to reveal students’ patterns of access to the digital learning elements in 2009, and 2010. These usage patterns were tracked throughout a Semester, and compared with students’ assessment outcomes to ascertain whether a relationship between usage and assessment outcome existed. The results revealed that students’ access to the digital learning objects was related to both assignment and overall grade outcomes. Analysis of Variance (ANOVA) method was used to reveal that responses to the student evaluation question “The learning resources (e.g., handouts, web resources) are valuable for my understanding of the subject” revealed a significant result across the years 2006-2010 as students reported increasingly greater satisfaction with the available learning resources.
Flexible design concept is a relatively new trend in airport terminal design which is believed to facilitate the ever changing needs of a terminal. Current architectural design processes become more complex every day because of the introduction of new building technologies where the concept of flexible airport terminal would apparently make the design process even more complex. Previous studies have demonstrated that ever growing aviation industry requires airport terminals to be planned, designed and constructed in such a way that should allow flexibility in design process. In order to adopt the philosophy of ‘design for flexibility’ architects need to address a wide range of differing needs. An appropriate integration of the process models, prior to the airport terminal design process, is expected to uncover the relationships that exist between spatial layout and their corresponding functions. The current paper seeks to develop a way of sharing space adjacency related information obtained from the Business Process Models (BPM) to assist in defining flexible airport terminal layouts. Critical design parameters are thoroughly investigated whilst reviewing the available design alternatives and an evaluation framework is proposed in the current paper. Information obtained from various design layouts should assist in identifying and in defining standard performance matrices allowing architects to interpret and to apply those throughout the lifecycle of the terminal building.
SuperSlob: the development of a parametric component jointing regime for standard sheet materials

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The Castle, a collaboration between the School of Architecture & Design (UTAS) and Youth Futures Inc (YF), assists youth at risk of homelessness by deploying micro-dwellings to households experiencing spatial and emotional distress. The digital construction system has been tailored specifically for low-skilled labour through reliable and predictable component jointing, a limited palette of materials, minimal tooling and assembly instructions. A detailed interrogation of the construction ‘grammar’ has resulted in the development of a software plugin that increases the efficiency and reliability of the design, documentation and fabrication process. The plugin, called ‘SuperSlob’ (the term ‘slob’ derived from the slot and tab connection) has been developed by students and staff at UTAS, in partnership with a software programming consultant. The brief for SuperSlob has prioritised ‘accessibility’ so the Castle construction system can progress from limited ‘customised production’ toward mass customisation. SuperSlob integrates all stages of design and documentation – from module and material parameters, to component configuration, ‘router-ready’ jointing, and file management. SuperSlob is currently being tested by students in two ‘Learning by Making’ studios: a ‘Crisis Accommodation Bus’, and ‘Design Island’. Feedback from the users of the plugin will contribute to the further development of SuperSlob.
This paper reports on the early findings of an Australian Learning Teaching Council (ALTC/OLT) funded project – “Enhancing and Assessing Group and Team Learning in Architecture and Related Design Contexts.” This is a two-year project investigating good practice in Australian higher education for the teaching of teamwork in the design disciplines, with a focus on architecture. Drawing upon a review of the literature and discussions with teachers and practitioners, the paper considers how teamwork is conceived in the context of the design disciplines. The paper explores notions of team and group design activities in the literature, identifying the key elements and characteristics of effective teams and groups. While a great deal of research exists on effective teamwork in organizational, management and general education literature, this research found a clear gap in knowledge relating to teaching teamwork in architecture and related design contexts. Suggestions are made about the ways in which theories on effective teamwork in organisations might elucidate teaching and assessment of effectively functioning student design teams. The literature review prompted five key questions, outlined here, around the conceptualisation of teamwork in design education that were subsequently discussed with educators and practitioners, thus allowing the identification of issues, problems and solutions common to all fields of design.
Aorangi House is a recently refurbished 12-storey commercial building located in the CBD of Wellington, New Zealand. This paper outlines the nature of its environmental re-design, and describes its performance in terms of energy consumption and users’ perceptions. The aim was to maximise the use of natural ventilation and lighting, and employ a mixed-mode system to provide natural ventilation and cooling. Energy studies carried out over the first two years of operation revealed an Area Energy Use Index (AEUI) of 101 kWh/m2.year for the period 2011 to 2012. A PROBE-style Workplace Questionnaire was used to gauge the perceptions of staff to a range of factors, ranging from temperature and air quality to health and productivity. With a Summary Index of +2.12 (on a -3 to +3 scale) the building performs particularly well overall from the users’ point of view. The building was one of the first refurbishments to achieve a 5-Star Design rating from the New Zealand Green Building Council.
The importance of field study to the measurement and prediction of thermal comfort is well known. Field-based studies have served to highlight the real-world relationship between adaptive opportunity and thermal preference and acceptability reported by occupants. While real-world complexity is integral to field-based study, the reasons why it influences the comfort responses of participants is not well understood. This paper presents the results of an in-depth study carried out in an office where occupants have a high level of control over their thermal environment. The building operates in changeover mixed-mode configuration, with natural ventilation mode enforced when ambient conditions are deemed favourable, and occupants able to either naturally ventilate or operate a personal air conditioner outside of those times. Thermal conditions at work areas were measured alongside a participant questionnaire of thermal comfort, acceptability and preference. State data for building mode and adaptive devices were recorded. The results were contextualised using qualitative interviews, during which participants discussed their relationship to their workspace in terms of comfort and adaptive habits. The study raised questions on cognitive tolerance, reaction to discomfort, responsibility taken for personal comfort needs, as well as personal factors, such as clothing levels and thermal disposition, which may influence responses.
Impact of green infrastructures on urban microclimates: A critical review

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Temperature is the most relevant factor affecting the urban microclimate. Increased urban density, hard surfaces with inappropriate thermal property and lack of vegetation have resulted in the increase of temperatures in urban areas and high pollution levels. In return, greening is known as the best solution for mitigating high temperatures in urban context, thus has recently become the focus of extensive research. In this paper, a systematic literature review is performed to investigate the effect of vegetation on microclimate in urban context focusing on air temperature, humidity and wind speed. Parks and urban green spaces are the features studied with respect to two different methodologies used for data collection: on-site measurements and numerical calculation or modeling. The aim of this study is to compare results of the two methodological approaches used by researchers in order to investigate their similarities and differences. The comparison shows that both methods can be applied for studies at various scales, from circumscribed areas such as parks and their surroundings (micro scale) to investigation including the whole city (mesoscale). However, due to costs and time constrains, studies using field measurements are mostly limited to one season thus lacking comparative analysis of effects of vegetation over longer periods. Instead, the use of simulations and modeling can help including different temporal scenarios and a variety of parameters in the study, even though in a more simplified form than in real case studies. According to the review, while empirical data collection was more popular in the past, simulations and modeling have been used more frequently in recent years due to the advantages mentioned above. It also shows that best results can be achieved integrating the two approaches, where field measurements can either provide realistic data for simulation input or represent a means for validation of modeling outputs.
Within the public realm, urban design guidelines are one set of a range of instruments used to control or influence public and private works so as to optimise the production of reliably ‘good’ built environments. They address the public domain of our cities as well as private domain impacts on the public domain. Guidelines are public documents, which to be successful their basis must be accessible for critical review. This is necessary so that guidelines can reflect shared community values and be accountable. The model in this paper describes ‘good practice’ procedures for the preparation of guidelines that are based in theory and practice. It includes discussion on substantive matters that are relevant to built environments. It seeks to establish high quality decisions as well as high quality information upon which decisions are made. Both the information and decisions are intended to be transparent and thereby accountable. The model is grounded in critical study of existing urban design guidelines in Australia and overseas as well as in theories and methods derived from the literature. It is structured to reflect a managed problem-solving approach under the headings of: intentions; preparation; implementation; performance. A further heading, ‘substantive content’ parallels the other headings and addresses the subject matter of guidelines with cross reference to underpinning theory texts and to analysis techniques. The model is not a sequential action checklist, but rather is a heuristic one wherein each step may inform previous steps and thereby potentially modify the conclusions of that step, and in turn the outcome, which may be tested. However such ‘reflection-test’ processes cannot proceed indefinitely and informed decisions are expected to be made within time and budget constraints. It brings theoretical and practice knowledge together to help produce better functioning built environments within which aesthetics and symbolism are considered as functions, in the Lang sense (1994) of human concerns being a function, together with physical, ecological and economic aspects.
A public health crisis is looming. The recent Australian Bureau of Statistics report ‘Australian Health Survey’ (October 2012) highlighted increasing overweight/obesity and alarmingly low rates of exercise in the country’s population. It is projected that the problem will decimate the nation’s future capacity to pay for health-support as the population ages, unless the trend can be turned around. There is now very widely accepted convergent research bridging the public health sector, environmental psychology, town planning, transport planning and urban design that concludes the importance of better urban design of the built environment in facilitating better public health outcomes. Beyond concerns for public health, including climate change impact and reliance on fossil fuels, more and more signals point to the lack of sustainability of our current lifestyles. Many remedies are being explored and central to most of them is the harsh reality that the built environment is the major contributor to sustainability problems and consequentially must be where solutions are found. Urban design is a slow-acting force but potentially a powerful one that has taken over twenty-five years in Australia to gain traction at a leadership level. The value of urban design is constantly being challenged but as the evidence mounts that good urban design matters significantly, there is a need to communicate best knowledge. Contributing to this is the need for more case studies to demonstrate solutions that can be taken up and applied across communities. Social ecology and planned behaviour theory confirms that urban design attributes need to be combined in order to reliably deliver good results. An integrated approach is required. A case study is presented that shows how a country town has responded to the evidence and has developed practical policies underpinned by theory to guide the future design and upgrading of the built environment to help improve public health.
A holistic framework for transforming urban cities into ‘zero waste cities’

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Our consumption-driven society produces an enormous volume of waste every day. Over-crowded cities do not have a good quality of urban life. Together with the numerous problems that exist in these cities, they have resources that are plundered unsustainably and an ever-increasing generation of waste. This immensely high volume of waste is leading to overflowing landfills, the destruction of natural habitat and loss of biodiversity. Continuous depletion of finite natural resources by urban populations is leading to uncertainty about the food and water supply, energy costs, housing affordability and industrial productivity. This paper outlines the concept of ‘zero waste’ and translates the zero waste idea into the city scale. Zero waste is a holistic approach, which means designing and managing products and processes systematically to avoid and eliminate the waste of materials and resources. Eventually, it conserves and recovers all resources from waste streams. Hence, in a zero waste city (ZWC), unnecessary or avoidable waste is not produced and the end-of-life product is used as a resource, a holistic zero waste city framework is proposed in this paper based on six key design principles to transform current cities into zero waste cities. In addition the paper presents an assessment tool called zero waste index (ZWI) to evaluate the zero waste city performances. Zero waste index would assist to measure the efficiency of waste management systems in different cities in regards to waste avoidance, resource recovery and restoration of natural resources. Hence, zero waste index would be a helpful tool to improve current waste management systems towards a zero waste management systems.
HDR luminance measurement: Comparing real and simulated data

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This research explores the adequacy of computer simulation using HDR photography to map the luminance distribution both of the sky and of the building interiors. The BRANZ Building Energy End-Use Study (BEES) team currently have one internal lighting measurement point recording light levels in each of more than 100 randomly selected commercial buildings in New Zealand. The light meter typically records illuminance on a desktop within the building every ten-minutes for a two week period. Using this data, a thesis will be conducted exploring the utility of HDR imaging as a supplement to the use of a single internal light measurement in the analysis of daylight potential in New Zealand’s commercial building stock. This research paper outlines the preliminary research and results of this thesis study. This research was conducted in the lighting laboratory at the School of Architecture and Design, Victoria University of Wellington using a physically scaled model and a US$50 fisheye lens and an Android Smartphone. The outcome of this preliminary research shows that this method can be a viable option when it comes to daylight analysis in a building.
The Proceedings of the 46th Annual Conference of the Architectural Science Association (ASA) formerly known as the Australian and New Zealand Architectural Science Association (ANZAScA) were published in Gold Coast City, Australia by the Department of Architecture, Griffith University.

The Technical Committee of ASA (ANZAScA) 2012 received 84 abstracts for this conference, from which 45 papers were accepted for presentation at the conference and inclusion in these proceedings.

Each paper has been double blind refereed by members of the ASA (ANZAScA) 2012 International Review Committee. This Committee was selected by the technical Committee. All papers accepted for the proceeding were reviewed by two referees. Where there was a difference of opinion regarding acceptance the paper was reviewed by a third referee, whose decision was final.

All papers were matched, where possible, with reviewers in the same specialist field and with similar academic interests to the author.