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1 ABOUT THE INSTITUTE

1.1 Introduction
The Institute for Infrastructure Engineering (IIE) was formed on 1 January 2012. It builds on the work of the Civionics Research Centre at UWS and expands the areas of engineering research beyond civil engineering and electronic engineering into the areas of structural systems, computational mechanics, construction materials, and structural health monitoring.

1.2 Mission
The IIE aims to develop innovative solutions that address the effective design and maintenance of civil infrastructure problems. A network of efficient and well-maintained infrastructure is crucial to the growth and prosperity of Australia.

The areas into which the IIE will initially focus its research efforts are:

» Infrastructure Systems (IS)
» Infrastructure Computations (IC)
» Infrastructure Materials (IM)
» Infrastructure Health Monitoring (IHM)

IIE will build on these research strengths based on the work of the Civionics Research Centre (CRC) and by establishing new and strengthening existing strategic research partnerships and collaborating with researchers within UWS, nationally and internationally.

Central to meeting IIE’s broad aims and the University’s research objectives is the maintenance of a vibrant research environment and recruitment of high-performing researchers and PhD candidates, underpinned by the University’s commitment to achieve excellence in research.

1.3 Goals
The IIE goals are clearly aligned with the UWS strategic plan and include

» Increase external research income to the University
» Increase the number of fields of research at UWS operating above or well above world standard
» Increase the number and concentration of funded research partnerships
» Ensure UWS attracts and graduates high quality HDR students to its areas of research strength

1.4 Institute Summary

» Location: The main office of Institute for Infrastructure Engineering is located in Room ZG06, Building Z, Kingswood Campus, UWS.
» In 2013, the Institute comprised ten full-time academic staff members and a number of active research collaborators from the School of Computing, Engineering and Mathematics. The total number of Higher Degree Research candidates principally supervised by members of the Institute in 2013 was nine.
2013 marked the second full year operation of UWS’s Institute for Infrastructure Engineering (IIE). IIE researchers continued their efforts in attaining research excellence by undertaking research funded by Australian Research Council (ARC), Future Fellowship (FF) and Discovery Projects (DP) and other research partnerships. IIE also strived to secure external research income, build research partnerships nationally and internationally, and attract high quality HDR students.

In addition to UWS’s NATA accredited Structural Research and Testing Laboratory, IIE continued to build its research capacity by investing in new equipment for the newly established Infrastructure Health Monitoring Laboratory. Major equipment acquisitions, including state-of-the-art wireless sensors and data acquisition system and a 6-degree-of-freedom Hexapod shaker platform, also paved the way for establishing a structural dynamics and control laboratory in collaboration with researchers at the School of Computing Engineering and Mathematics (SCEM).

Some of the major achievements of IIE in 2013 included:

- Continuation of an ARC Future Fellowship and two ARC Discovery Projects.
- Funding awarded for two ARC Linkage Infrastructure Equipment and Facility.
- Establishment of international research partnerships with University of Houston and Dalian University of Technology with the support of IIE International Research Initiatives Scheme (IRIS).
- Technical visits to foster research collaboration with Tianjin Haixu Technology Development Company, China, Universiti Teknologi Malaysia, University of Liverpool, Bradford University, University of Birmingham, University of Nottingham, Istanbul Technical University and Cukurova University, Turkey, University of Western Ontario, and University of Minnesota, USA.
- Hosting Institute for Infrastructure Engineering Annual Conference at Parramatta Holiday Inn on 29 November 2013, featuring one Australian (University of Technology Sydney) and three international (Tsinghua University, China, Colorado State University, USA and Missouri University of Science and Technology, USA) keynote speakers.
- IIE members published 2 book chapters, 59 journal papers and 84 conference proceeding papers. The majority of these papers are published in ISI and ERA ranked journals with high impact factors.
- Commencement of two PhD candidates funded by IIE PhD Scholarships.
- Seven offers of IIE PhD Scholarships were made in 2013 with five students expected to commence their candidature in 2014.

In 2013, Professor Bijan Samali was appointed Professor of Structural Engineering and assumed the role of Program Director of Infrastructure Systems and Dr Yu Zhang (Peter) was appointed Post-doctoral Fellow in Infrastructure Computation, both commenced duty in November 2013. Miss Sally Ji and Ms Summer Luo also joined IIE in 2013, as a Research Assistant and Research Officer, respectively.

Much-needed new office accommodation was completed in mid-2013 to house the expected increase in IIE staff and HDR students.

IIE looks forward to continuing growth in 2014 by recruiting researchers in structural engineering, infrastructure materials, infrastructure computations and infrastructure health monitoring, with a focus on research capacity building. This will contribute to strengthening UWS’s research presence and competitiveness, particularly in attracting external funding from both government funding agencies and industries, building national and international research partnerships, and attracting high quality local and international HDR students. These will facilitate UWS achieving the goal of demonstrated excellence in research and scholarship on the world stage.

Professor Kenny Kwok
Acting Director,
Institute for Infrastructure Engineering
3 REPORTS ON EACH PROGRAM/THEME

The themes of research of the Institute for Infrastructure Engineering are:
» Infrastructure Systems
» Infrastructure Computations
» Infrastructure Materials
» Infrastructure Health Monitoring

3.1 Infrastructure Systems

Infrastructure systems provide services whose operations are crucial for the economic wellbeing and security of a nation and its citizens. They are important in judging a country or region’s development. The Infrastructure Systems research program at IIE involves the analysis, assessment, design, maintenance and repair of infrastructure systems under different environmental conditions, which is an area of wide application. The research is concerned with the safety, reliability and mitigation strategies of infrastructure systems such as bridges, buildings, dams, hoppers and silos, roads, and water distribution systems (pipe networks). The goal of the research is to develop infrastructure systems that are more efficient and economical to construct, more durable and adaptable over their life-cycle, and more resistant to infrastructure hazards.

Professor Bijan Samali has been the Program Director – Infrastructure Systems since he joined IIE in November 2013. Before that, Professor Zhong Tao served as the Acting Director of this Program.

Major achievements and highlight of activities in this program in 2013 include:
» Due to the passive confinement provided by the steel jacket for the concrete core, the behaviour of the concrete in a concrete-filled steel tubular (CFST) column is always very challenging to be accurately modelled. In collaboration with Dr Zhi-Bin Wang and Associate Professor Qing Yu, Professor Zhong Tao developed a new finite element model for CFST columns. The new model is very versatile and accurate to be used in modelling CFST columns, even when high-strength concrete and/or thin-walled tubes are used.

» A new concept in dealing with wind and earthquake induced energy dissipation in building structures is being developed with promising results under the supervision of Professor Bijan Samali. This system utilizes the movement of the outer skin of a double skin facade system to dissipate seismic or wind induced motions by incorporating yielding or dissipative elements between the fixed inner and movable outer skin of a double skin facade system. This project is supported by an ARC Linkage grant and involves two PhD students.

» Systematic investigations, including theoretical modelling, experimental verification, control-structure interaction, control strategies and design guidelines development, have been carried out by Dr Chunwei Zhang and his collaborators on Active Mass Driver, particularly the Electromagnetic Driving Mass Damper. Dr Chunwei Zhang received the Second Class National Prize for Progress in Science and Technology from the People’s Republic of China for his research titled “Structural Vibration Control and its Applications”. This is one of the top academic achievements acknowledged by the country.

» Through research collaboration with Professor Brian Uy at the University of New South Wales, and Dr Stephen Hicks at Heavy Engineering Research Association (HERA), New Zealand, Dr Won Hee Kang and Professor Zhong Tao conducted reliability based capacity factor calibration work on steel I-beams and concrete filled steel tubes. This work confirmed the safe use of overseas steel beams in Australia based on manufacturing tolerances of different countries, and estimated the safety of the factors given in the current Austrian code for concrete filled steel tubes.

During the IIE Annual Conference in 2013, some of the above research results were presented. A keynote speech was given by Professor Bijan Samali, entitled “Application of smart facade systems in reduction of wind induced structural response”.

In 2014, planned research projects on the Infrastructure Systems program include: finite element analysis of Rolled Compacted Concrete (RCC) dams in terms of their seepage, thermal gradient and seismic response; design and optimization of smart, energy dissipating, double skin facade systems for structural control of wind and earthquake excited buildings; analysis and design guidelines for blast resistant structures; Seismic properties of connections composed of Concrete Filled Steel Tube Columns (CFSTCs and steel-concrete composite beams; hybrid stainless-carbon steel composite beam-column joints; disaster prevention and mitigation technologies on the structural system level and applications; composite steel-concrete beams with recycled aggregate and steel fibres; reliability assessment of steel columns based on the updated load combinations in AS4324; and dynamic characteristics of recycled concrete beams.
## Conferences, symposia and workshops

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| The SPIE 20th Annual International Symposium on Smart Structures and Materials + Non-destructive Evaluation and Health Monitoring | 10 – 14 March, San Diego, California, United States | Development of adaptive seismic isolators for ultimate seismic protection of civil structures by Li J, Li Y, Li W, Samali B  
| The 2nd International Conference on Engineering and Applied Science | 15-17 March, Tokyo, Japan               | Online damage assessment based on symbolic time series analysis by Askari M, Li J, Samali B |
| New York City Bridge Conference                                      | 16-20 June, New York, USA              | The proposed Australasian composite bridge standard, AS/NZS 5100 Part 6, Steel and composite construction by Uy B, Hicks’ S, Kang W |
| International Symposium on Innovation and Sustainability of Structures in Civil Engineering | 6-7 July, Harbin, China                | Simulation based stochastic analysis of a dynamic system by Kang W, Zhang C, Yu Y |
| Australasian Wind Engineering Society Workshop                      | 18-19 July, Brisbane, QLD, Australia   | Wind induced vibration characteristics and model updating of Canton Tower structure by Xu H, Zhang C, Ou J  
Wireless typhoon-induced vibration measurement system for super high-rise building structures by Yu Y, Mao X, Zhang C, Li Z, Ou J  
AMD control analysis and parametric optimization for a wind excited tall building structure by Zhang C |
| The 18th International Conference on Soil Mechanics and Geotechnical Engineering | 2-6 September, Paris, France           | Seismic response of superstructure on soft soil considering soil-pile-structure interaction by Hokmabadi AS, Fatahi B, Samali B |
| World Congress on Advances in Structural Engineering and Mechanics   | 8-12 September, Jeju Island, South Korea | Behaviour and design of high strength steel-concrete filled columns by Uy B, Khan M, Tao Z, Mashiri F  
FEA modelling of curved concrete filled steel tubular (CCFST) trusses subjected to bending by Xu W, Han L, Tao Z  
Behaviour of concrete-filled steel tubular column to restrained steel beam joints after exposed to full-range fire by Song T, Han L, Tao Z  
Heat transfer analysis of hybrid stainless-carbon steel beam-column joints by Razzazzadeh A, Tao Z, Song T |
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<td>Finite element analysis on concrete-encased CFST columns subjected to heating and cooling fire</td>
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<tr>
<td>Behaviour of concrete filled steel tubular (CFST) triple-limb laced columns subjected to ISO 834 standard fire</td>
<td>Cui Z, Han L, Song T</td>
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<td>35th IAHR World Congress</td>
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<td>Study of blockage effect on scouring pattern downstream of a box culvert under unsteady flow</td>
<td>Sorourian S, Keshavarzi S, Ball J, Samali B</td>
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<td>1st Australasian Conference on Computational Mechanics</td>
<td>3-4 October, Sydney, Australia</td>
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<tr>
<td>A novel FRF-based damage localisation method using random vibration</td>
<td>Alamdari MM, Li J, Samali B</td>
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<td>The 10th Pacific Structural Steel Conference</td>
<td>8-11 October, Singapore</td>
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<td>Effects of binding bars on the integrity of end plate connections to concrete-filled steel tubular columns</td>
<td>Hassan K, Tao Z, Uy B</td>
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<tr>
<td>Concentrically loaded short high strength composite columns</td>
<td>Khan M, Uy B, Tao Z, Mashiri F</td>
</tr>
<tr>
<td>The 6th International Conference on Structural Health Monitoring of Intelligent Infrastructure</td>
<td>9-11 December, Hong Kong, China</td>
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<tr>
<td>Numerical investigations of material property changes and stress wave behaviour in timber utility poles</td>
<td>Yan N, Dackermann U, Li J, Samali B</td>
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<tr>
<td>Separation of bi-directional stress waves for the non-destructive condition assessment of in-service timber utility poles</td>
<td>Jozi B, Dackermann U, Braun R, Li J, Samali B</td>
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</table>
3.2 Infrastructure Computations

Computational methods have been widely used to study engineering problems and have continued to play an important role in IIE’s major research areas of civil, structural and material engineering that form integral part of IIE’s research themes: Infrastructure Systems and Infrastructure Materials.

Professor Kenny Kwok is the Program Director – Infrastructure Computations and is exploiting the strengths of computational techniques in multi-disciplinary projects, including studying the effects of bushfire-wind-structure interaction and the wind load effects on buildings, air ventilation and pollution dispersion in urban environment, and the effects of building motion on occupant manual task and cognitive performance and neurophysiological responses. These multi-disciplinary projects are conducted collaboratively with UWS researchers at IIE, School of Computing, Engineering & Mathematics (SCEM) and School of Medicine (SoM) and international collaborators based in Hong Kong and USA.

Dr Peter Zhang joined IIE in November 2013 as a Post-doctoral Fellow in Infrastructure Computations. Dr Zhang has a breadth of experience in the application of numerical techniques to a variety of engineering and bio-medical problems, including multi-phase flow, non-Newtonian flow and environmental fluid flow, and is expected to make a significant contribution to the infrastructure computation program.

Significant progress in research related to infrastructure computations have been achieved in 2013. Some noteworthy achievements are summarised hereunder.

» Professor Kenny Kwok, SCEM’s Dr Yaping He and Professor Bob Meroney from Colorado State University continued to investigate the flow characteristics of bushfire-enhanced wind and its effect on buildings using CFD software FDS and FLUENT, focusing particularly on the sensitivity of boundary conditions and grid size and density, and the wind load effects on different building geometries. A summary of this research was presented at the 12th Americas Conference on Wind Engineering held in Seattle in June 2013. Professor Meroney made a reciprocal visit sponsored by an IIE IRIS to UWS in November 2013 to present a keynote paper at the IIE Annual Conference and two research seminars at IIE. Professor Kwok and Dr He also collaborated with SCEM’s Dr Olivia Mirza to investigate the behaviour of simple building structures under the wind load effects created by the fire-enhanced winds.

» Professor Kenny Kwok and Dr Peter Zhang are developing a virtual wind tunnel using CFD technology to advance the fundamental understanding of wind-structure interactions to enhance the capability of IIE’s infrastructure computations program. Initially, this research built on the Professor Kwok’s collaborative research with Hong Kong Polytechnic University’s Professor J.L. Niu and Professor CM Mak to facilitate the development of building design and urban planning guidelines to improve air quality in urban environment. Professor Kwok and Dr Zhang are collaborating with Hong Kong Polytechnic University’s Dr Xiaoping Liu to benchmark computed results using the virtual wind tunnel with test results measured in HKUST’s boundary layer wind tunnel of pollutant dispersion in a high-rise residential building, in particular cross-contamination of air-borne pollutants and micro-organisms in a scenario akin to the severe acute respiratory syndrome (SARS) outbreak at Amoy Garden in Hong Kong in 2002.

SCEM’s Dr Ming Zhao is collaborating with Dr Peter Zhang and Professor Kenny Kwok to establish a water-sediment model using a novel computational method: Discrete Element Method (DEM) to study sediment transport, particularly sand scour around subsea structures such as pipelines and risers of offshore structures. This research is particularly relevant to the safety of the offshore oil and gas industry both in Australia and overseas.

» Professor Kenny Kwok, Professor Vaughan Macelfield (SoM) and Dr Darren Walton, Health Promotion Agency, New Zealand (HPA,NZ) continued their multi-disciplinary research on occupant response in wind-excited tall buildings using longitudinal study in Wellington New Zealand and motion simulator experiments at Hong Kong University of Science and Technology (HKUST). Dr Steve Lamb, an IIE PhD candidate supported by this ARC DP, completed his research and was awarded his PhD in December 2013. A monograph: “Wind-induced Motion on Tall Buildings: Design for Habitability” edited by Professor Kwok, Dr Burton and Dr Abdelrazaq was submitted for review in October 2013 for publication by ASCE Publishing.

» Professor Kwok was invited by Hong Kong Polytechnic University’s Faculty of Construction and Environment (FCE) and Research Institute for Sustainable Urban Development (RISUD) to deliver a FCE Public Lecture: “Effects of wind-induced building vibration on occupant wellbeing and work performance” and a research seminar: “The role of wind engineering in air ventilation and pollution dispersion in an urban environment” at RISUD’s Research Salon Series in early 2014.
Conferences, symposia and workshops

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<th>Event</th>
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<tr>
<td>The 12th Americas Conference on Wind Engineering</td>
<td>16-20 June, Seattle, Washington, United States</td>
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<td>Effects of wind-induced tall building vibrations on a tracking task</td>
<td>Wong K, Hau C, Kwok K</td>
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<td>Numerical study of pressure distribution around asymmetric building</td>
<td>He Y, Kwok K, Meroney R, Ly J, Choulet B</td>
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<td>structures subjected to fire enhanced wind</td>
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<td>Proceedings of European-African Conference on Wind Engineering</td>
<td>7-11 July, Cambridge, United Kingdom</td>
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<td>Effects of Wind-induced tall building vibrations on Human Motor</td>
<td>Wong K, Hau C, Kwok K, Gonetilleke R</td>
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<td>The occupant response to wind-induced tall building motion in New</td>
<td>Lamb S, Kwok K, Walton D</td>
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<td>Benchmark structural model case study</td>
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<td>Effects of building lift-up design on pedestrian level wind</td>
<td>Xia Q, Liu X, Niu J, Kwok K</td>
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<td>Effects of building configuration on ventilation performance of</td>
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<td>Sustainable energy harvesting control system for wind-induced</td>
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<td>The Eighth Asia-Pacific Conference on Wind Engineering</td>
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<td>Effects of building lift-up design on pedestrian wind environment</td>
<td>Xia Q, Liu X, Niu J, Kwok K</td>
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3.3 Infrastructure Materials

Engineering materials include both natural resources and man-made materials such as soil, water, cemented soil, geofoam, concrete, steel, timber, composite materials and recycled concrete. The performance of an infrastructure system is largely dependent on the properties of associated engineering materials. The Infrastructure Materials program in IIE covers the development, application, characterisation, recycling, remediation, disposal, modelling and monitoring of engineering materials as part of infrastructure design, development and management. It is a major supporting program of research in IIE. Major research areas of this program include (but are not limited to) high performance materials, materials at high strain rates and sustainable materials. Professor Zhong Tao is the Program Director – Infrastructure Materials. He has expertise in steel, concrete and composite materials.

Some notable achievements in 2013 in this program are summarised as below.

» Styrene Butadiene Rubber was used by Professor Bijan Samali to enhance the mechanical properties of polymer modified concrete (PMC). Conventionally, PMC is used as an over layer in the bridge decks or for the repairing of defected concrete structures subjected to marine environment. Due to the foaming phenomenon, PMC usually has low compressive strength. Research results indicate that the mechanical properties of PMC can be recovered remarkably by using appropriate antifoaming agent (defoamer) and proper curing method. The research recognised the potential of using PMC as a structural material.

» Concrete is one of the most widely used construction materials in the world. A research project was carried out by Professor Zhong Tao and Dr Tian-Yi Song to develop several new types of concretes, which have good fire behaviour and are cost-effective to be used in Australia. Preliminary material tests of the concretes were conducted at room temperature indicating that the new concretes have good ductility and compressive strength as the normal concrete. A new concrete furnace has been purchased for IIE and will be used to test the concretes in fire.

» Prestressed concrete structures have been widely used all over the world, and there is a growing need to study the postfire repairability of a structure if a fire occurs in it and no collapse happens after cooling. Based on statistical analysis, the effects of heat exposure on the modulus of elasticity, yield strength and tensile strength, as well as ultimate strain were analysed by Professor Zhong Tao for prestressing steel. A simplified stress-strain model was developed for prestressing steel after heating and cooling to room temperature.

» Working with Associate Professor Xin-Qiang Wang, Shandong Polytechnic, China, Professor Zhong Tao and Dr Tian-Yi Song proposed a stress-strain model for corner stainless steel and another model for flat and corner stainless steel after exposure to fire. The models have potential to be used widely.

» Through research collaboration with Associate Professor Vivian Tam, Dr Olivia Mirza and Dr Sepani Senaratne in the School of Computing, Engineering and Mathematics, UWS, Dr Won Hee Kang investigated the physical and mechanical properties of recycled aggregate concrete for the use in concrete beams. Initial experiments were conducted revealing the possibility of creating a new sustainable material for structural application.

» Dr Ken Tokeshi applied an innovative non-invasive technique called horizontal-to-vertical spectral ratio inversion to provide both a general geotechnical site characterisation and an evaluation of compacted ground. Also, the technique called Several Source One Receiver (SSOR), which is an active ambient vibration technique, was applied to obtain the experimental Rayleigh dispersion curve for site characterisation purpose.

Some of the research results mentioned above were reported at the IIE Annual Conference – one of the major IIE events held in Parramatta on 29 November 2013. During this conference, five presentations were arranged on the Infrastructure Materials Program, including a keynote speech given by Professor Lin-Hai Han. Professor Han is from the Department of Civil Engineering, Tsinghua University, Beijing, China. His presentation was entitled “New Developments on Concrete-Filled Steel Tubular Structures”.

Research projects on the Infrastructure Materials program in 2014 include: fire-resistant concrete; stainless steels in fire and after fire exposure; fire performance of blind bolts; dynamic properties of high-performance concrete; and vibration characteristics of concrete before and after fire exposure.
Conferences, symposia and workshops

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<tr>
<td>The 8th International Conference on Fracture Mechanics of Concrete and</td>
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<td>Concrete Structures</td>
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<td>Investigation on the durability of fibre reinforced concrete (FRC) exposed to marine environment</td>
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<td>Flexural toughness and ductility characteristics of polyvinyl alcohol fibre reinforced concrete (PVA-FRC)</td>
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<td>The 14th International Congress on Polymer Modified Concrete</td>
<td>17-20 April, Shanghai,</td>
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<td>Experimental investigation on mix design and mechanical properties of polymer modified concrete</td>
<td>Nabavi F, Nejadi S, Samali B</td>
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<td>Fifth North American Conference on the Design and Use of Self-Consolidating</td>
<td>12-15, May, Chicago, IL,</td>
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<td>Energy dissipation in self-compacting concrete with or without fibres in compression</td>
<td>Aslani F, Nejadi S, Samali B</td>
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<td>The First International Conference on Concrete Sustainability</td>
<td>27-29 May, Tokyo, Japan</td>
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<td>Composite Construction VII</td>
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<td>Effect of polyvinyl alcohol fibre on dynamic properties of concrete</td>
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<td>The 3rd International Conference on Sustainable Construction Materials &amp;</td>
<td>18-21 August, Kyoto,</td>
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<td>Fifth International Conference on Structural Engineering, Mechanics and</td>
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<td>Damping properties of polyvinyl alcohol fibre reinforced concrete</td>
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<tr>
<td>Flexural and tensile characteristics of polyvinyl alcohol fibre reinforced concrete (PVA-FRC)</td>
<td>Noshini A, Vessalas K, Samali B</td>
<td></td>
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<tr>
<td>Influence of polyvinyl alcohol fibre addition on fresh and hardened properties of concrete</td>
<td>Noshini A, Samali B</td>
<td></td>
<td></td>
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<tr>
<td>The 38th Australasian Universities Building Education Association Conference</td>
<td>20-22 November, Auckland, New Zealand</td>
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</tr>
<tr>
<td>Shrinkage development of recycled aggregate concrete and future directions of using steel fibers as a cost-effective option</td>
<td>Tam V, Mirza O, Senaratne S, Kang W-H, Kotrayothar D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seventh International Conference on Construction in the 21st Century</td>
<td>19-21 December, Bangkok,</td>
<td></td>
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<tr>
<td></td>
<td>Thailand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycled aggregate concrete: Strength development and future perspectives on steel fibers and cost-benefit analysis</td>
<td>Tam V, Mirza O, Senaratne S, Kang W-H, Kotrayothar D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.4 Infrastructure Health Monitoring

In 2013 the IIE Infrastructure Health Monitoring (IHM) program focused on wireless power transmission to antennas/sensors embedded in concrete members and developing microwave and piezoelectric-based sensor and antenna technologies to monitor the performance of concrete members (Associate Professor Sergiy Kharkivskiy and Dr Kwok Chung), seismic reliability assessment of lifeline networks and a stochastic reliability analysis framework (Dr Won Hee Kang and Dr Chunwei Zhang) and the application of the ambient vibration measurements to assess the dynamic characteristics of buildings, as a tool for performing health monitoring of infrastructure (Dr Ken Tokeshi), Associate Professor Sergiy Kharkivskiy is the Program Director – Infrastructure Health Monitoring. Multi-disciplinary research of this program is conducted by specialists with expertise in Electrical and Computer Engineering, Civil/Structural Engineering and Mechanical Engineering. IIE hosts international visitors working on wireless sensing technology, smart control and health monitoring trends.

Achievements for the IHM program for 2013 are as follows:

> A wireless microwave power transmission in concrete member has been investigated using a two-antenna setup with a recently proposed embeddable antenna module. The module consists of a rectangular microstrip patch antenna, a rectifier circuit and a dielectric housing. The housing was optimized to protect the module from the physical, chemical and electromagnetic influence of the surrounding material. The simulation and measurement results for transmission coefficients obtained with early-age (15-day) concrete specimens were in good agreement. The feasibility of the two-antenna setup for wireless power transmission to sensors embedded in concrete member was demonstrated.

> Measurement and monitoring on microwave reflection properties of concrete and mortar specimens were performed at X-band (8.2 GHz – 12.4 GHz) during hydration, Dependencies of the reflection coefficient and conductance on water-to-cement ratio and effect of coarse aggregates in the specimens are demonstrated. It is shown that the decays on magnitudes of reflection coefficients of concrete and mortar specimens have different rates versus days. The measurement of stress wave transmission properties in early-age concrete and mortar specimens were also performed using embedded piezoelectric-based transducers called “Smart Aggregates (SAs)” at frequency range of 100 Hz – 150 kHz. Dependencies of the resonant peak amplitude and frequency of power spectrum density on water-to-cement ratio and effect of coarse aggregates in the specimens are demonstrated.

> A 3-axis multifunctional imaging system was designed, built and tested using samples pertinent to construction materials and structures. This imaging system can provide faster scan, contour following, optimization of standoff distance, contact spot measurements, etc. The results demonstrated capability of the system to provide the detection and evaluation of flaws in complex shape and layered construction materials and members. Analysis and systematization of data related to the development and application of novel microwave and millimeter wave antenna arrays was done. It was shown that these antenna arrays can provide high-resolution and rapid imaging for non-destructive evaluation of composite materials.

> Two types of wideband circularly-polarized (CP) antennas have been investigated and their performances were improved by reducing 1) mutual coupling between elements and 2) back-radiation, thickness and cost of slot antenna using metasurface and metamaterial transmission-line (MML). Moreover, a high directivity CP antenna array with MML-based feed network has been created. This work has paved the way for future embedded antenna arrays for RF energy scavenging and wireless power transmission to embedded sensors.

> New methods for post-hazard reliability analysis of lifeline network systems were developed for connectivity analyses and prompt decision making. The methods provided the rapid estimation of seismic performance measures of large networks and the connectivity of network under hazard events. In addition, a stochastic reliability analysis framework for calculating the system-level first-passage probability of the structural responses of multi-degree-of-freedom structural systems was developed. The framework was applied to a simple 16-storey steel frame structure, and the first-passage probability of 16 locations and the series system passage probability of the entire system were estimated.

IIE provided funding for IIE International Research Initiatives Scheme (IIE IRIS) project “Development of an on-board decision support system for offshore vessel operations” (CIs: Dr. Won Hee Kang and Dr Chunwei Zhang) to conduct research collaboration with A/Prof Yan Yu at Dalian University of Technology (DUT), China. Under this project, the PI A/Prof Yu visited IIE in July 2013 and conducted experiments on vibration tests of damaged steel beams and existing bridges, made a presentation, and had discussions for future publications and project proposals.
The CIs, Dr. Kang and Dr. Zhang visited DUT in Dec 2013 and made presentations, laboratory tours, and discussions. In addition, National Natural Science Foundation of China (NSFC) provided funding to DUT for a Research Fellowship for International Young Scientists project, entitled: “Development of an on-board decision support system for offshore operations,” with Grant No. 51350110230 (Dr Won Hee Kang) to conduct research in collaboration with DUT. Under this project, the partner organization is conducting dynamic test on bridge cables and steel frames. Dr. Kang will visit DUT in 2014 under the support of this project to have detailed discussion on the completion of this project.

Another IIE IRIS project “Experimental investigations into the response of microwave and piezoelectric-based sensor techniques interacting with cementitious specimens” was conducted by a collaborative team including CIs A/Prof Sergiy Kharkivskiy and Dr Kwok Chung, and PI Prof Gangbing Song from University of Houston (UoH), TX, USA. Prof Song visited the IIE in July-August, 2013, while A/Prof Kharkivskiy and Dr Chung visited UoH in November, 2013. During his visit to IIE Prof Song gave a seminar entitled “Recent Advances in Smart Aggregate Research”, met with IIE academic staff, helped to arrange and test a piezoelectric-based (PB) sensor setup with Smart Aggregates and to conduct preliminary measurements of concrete specimens. The results of measurements of early-age concrete specimens obtained in UoH in the framework of the project were also discussed. An experimental investigation into stress-wave transmission properties and microwave reflection properties of concrete and mortar specimens with different water-to-cement (w/c) ratios has been conducted in IIE. During the visit of IIE delegation (i.e., A/Prof Kharkivskiy and Dr Chung) to the UoH the results of the experimental investigations were presented at the seminar of the Smart Materials and Structures Laboratory. Potential publications and grant proposals were also discussed.

Yeon Kyoung Foundation in South Korea provided funding for a research project “Risk assessment and management of water supply networks,” (CI: Dr Won Hee Kang). A visiting research fellow Dr Zunfeng Du in IIE is currently partially supported by the funds from this project.

Effective collaboration has been established with the Applied Microwave Nondestructive Testing Laboratory, Missouri University of Science and Technology (MS&T), USA (Director Prof Reza Zoughi). Preliminary images of composite materials have been obtained within collaborative work with MS&T using the IIE microwave imaging system and one conference proceedings paper has been submitted in 2013. Prof Zoughi presented a keynote speech “Evolution of microwave and millimeter wave imaging for non-destructive evaluation (NDE) applications” at the IIE Annual Conference 2013 followed by preparing and submitting a collaborative ARC DP 2015 proposal “Advanced microwave imaging of composite construction materials and members” (CI: A/Prof Sergiy Kharkivskiy; PI: Prof Zoughi). To enhance a collaboration with colleagues in the area of structural health monitoring in Australia, Dr Chunwei Zhang attended the 5th Annual Workshop of Australian Network of Structural Health Monitoring (ANSHM), November 2013, Melbourne, Australia, where he gave the presentation entitled “Development of a wireless sensor structural health monitoring system for tension force detection of bridge cables” by Dr Chunwei Zhang, A/Prof Yan Yu, Dr Xinquan Zhu and Dr Won Hee Kang. IIE will host ANSHM workshop in November 2014.
Conferences, symposia and workshops

<table>
<thead>
<tr>
<th>Conference and Conference Details</th>
<th>Date and Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>TENCON, 2013 Mutual coupling between circularly polarized H-shaped patch antennas</td>
<td>17-19 April, Sydney, Australia</td>
</tr>
<tr>
<td>TENCON, 2013 A dual band-notched UWB monopole antenna with C-shaped slot and hairpin slot</td>
<td></td>
</tr>
<tr>
<td>IEEE International Instrumentation and Measurement Technology Conference, I2MTC 2013 An embeddable microwave patch antenna module for civil engineering applications</td>
<td>6-9 May, Minneapolis, USA</td>
</tr>
<tr>
<td>IEEE International Instrumentation and Measurement Technology Conference, I2MTC 2013 An implantable ences microstrip ring rectenna for wireless biomedical applications</td>
<td></td>
</tr>
<tr>
<td>The 11th International Conference on Structural Safety and Reliability (ICCOAR2013) Seismic performance assessment of interdependent lifeline networks using logical expansion of recursive decomposition algorithm</td>
<td>16-20 June, New York, USA</td>
</tr>
<tr>
<td>The 5th International Symposium on Innovation &amp; Sustainability of Structures in Civil Engineering (ISISS-2013) Simulation based stochastic analysis of a dynamic system</td>
<td>6-7 July, Harbin, China</td>
</tr>
<tr>
<td>IEEE iWEM, 2013 Metamaterial-line fed circularly polarized slot-loop antenna with wideband performance</td>
<td>1-3 August, Hong Kong</td>
</tr>
<tr>
<td>IEEE iWEM, 2013 An efficient two-step CPML for 3-D LOD-FDTD</td>
<td></td>
</tr>
<tr>
<td>International Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures, (SMAR 2013) Microwave sensor technologies for structural health monitoring of infrastructure</td>
<td>9-11 September, Istanbul, Turkey</td>
</tr>
</tbody>
</table>
4.1 People

Researchers from School of Computing, Engineering and Mathematics associated with IIE
4.2 Research Projects

The IIE is involved in two new Australian Research Council (ARC) grants which will commence in 2014. Professor Kenny Kwok was involved in two ARC LIEF (Linkage Infrastructure Equipment and Facilities) projects totalling $1.4 million. Details of these projects are given below.

### Projects funded from 2013

<table>
<thead>
<tr>
<th>Funding Body</th>
<th>Chief Investigator</th>
<th>Project Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC</td>
<td>Professor Kenny Kwok</td>
<td>An Australasian facility for the automated fabrication of high performance bespoke components (via UNSW)</td>
<td>$ –</td>
</tr>
<tr>
<td>ARC</td>
<td>Professor Kenny Kwok</td>
<td>National Facility for Cyclic Testing of High-Speed Rail (via University of Wollongong)</td>
<td>$ –</td>
</tr>
<tr>
<td>Tianjin Haixu Technology Development Co, LTD</td>
<td>Dr Chunwei Zhang</td>
<td>Monitoring, evaluation and control of ship motions for offshore infrastructure construction</td>
<td>$ 36,413</td>
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</tbody>
</table>

### Projects continued in 2013

<table>
<thead>
<tr>
<th>Funding Body</th>
<th>Chief Investigator</th>
<th>Project Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC</td>
<td>Professor Kenny Kwok, Dr. Chunwei Zhang</td>
<td>National Facility for Physical Blast Simulation (NFPBS)</td>
<td>$ –</td>
</tr>
<tr>
<td>ARC</td>
<td>Professor Kenny Kwok</td>
<td>Occupant comfort, cognitive performance and task performance in wind-excited tall buildings</td>
<td>$ 68,901.00</td>
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<tr>
<td>ARC</td>
<td>Professor Zhong Tao</td>
<td>Hybrid stainless-carbon steel composite beam-column joints at ambient and elevated temperatures</td>
<td>$ 150,980.00</td>
</tr>
<tr>
<td>ARC</td>
<td>Professor Zhong Tao</td>
<td>Behaviour and design of concrete-filled stainless steel tubular columns at ambient and elevated temperatures</td>
<td>$ 97,935.00</td>
</tr>
<tr>
<td>UWS</td>
<td>Dr Chunwei Zhang</td>
<td>Monitoring, evaluation and control of ship motions for offshore infrastructure construction</td>
<td>$ –</td>
</tr>
<tr>
<td>Yeon Kyoung Foundation</td>
<td>Dr Won Hee Kang</td>
<td>Risk assessment and management of water supply networks</td>
<td>$ –</td>
</tr>
</tbody>
</table>

**Total Income** $ 354,229.00
4.3 Publications

Summary of 2013 Research Activity, Outcomes, and Impact

In 2013 IIE members produced 2 book chapters, 59 journal papers and 84 conference papers. The members published 39 Institute for Scientific Information (ISI) papers and 45 Excellence in Research for Australia (ERA) papers. More than 80% of the papers published by IIE members were in journals that had a greater median impact factor for their particular subject area than the overall ISI median impact factor for that subject area.

The total number of journal publications increased by 51% from 2012.

Research Quality (Publications)

Thomson Reuters (ISI) Impact Factor Analysis

The impact factor, often abbreviated IF, is a tool for evaluating journals. It is a measure reflecting the average number of citations to articles published in science and social science journals in a given year. ISI offered bibliographic database services and its specialty citation indexing and analysis.

<table>
<thead>
<tr>
<th>Subject Category</th>
<th>No. of publications for the Institute in this Category</th>
<th>Median Impact Factor for Subject (from ISI)</th>
<th>The Median Impact Factor for the Institute publications in this subject category</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGINEERING, CIVIL</td>
<td>14</td>
<td>0.786</td>
<td>1.330*</td>
</tr>
<tr>
<td>ENGINEERING, ELECTRICAL &amp; ELECTRONIC</td>
<td>6</td>
<td>1.103</td>
<td>2.006*</td>
</tr>
<tr>
<td>ENGINEERING, GEOLOGICAL</td>
<td>4</td>
<td>0.861</td>
<td>1.246*</td>
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<tr>
<td>CONSTRUCTION &amp; BUILDING TECHNOLOGY</td>
<td>2</td>
<td>0.745</td>
<td>0.649</td>
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<tr>
<td>ENGINEERING, MECHANICAL</td>
<td>2</td>
<td>0.770</td>
<td>1.613*</td>
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<tr>
<td>ENGINEERING, MULTIDISCIPLINARY</td>
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<td>0.707</td>
<td>0.695</td>
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<tr>
<td>MATERIALS SCIENCE, MULTIDISCIPLINARY</td>
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<td>1.250</td>
<td>2.159*</td>
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<tr>
<td>NEUROSCIENCES</td>
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<td>2.872</td>
<td>1.737</td>
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<tr>
<td>COMPUTER SCIENCE, HARDWARE &amp; ARCHITECTURE</td>
<td>1</td>
<td>0.981</td>
<td>1*</td>
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<tr>
<td>COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS</td>
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<td>1.328</td>
<td>1.393*</td>
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<tr>
<td>ENERGY &amp; FUELS</td>
<td>1</td>
<td>1.718</td>
<td>1.514</td>
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<tr>
<td>ENGINEERING, BIOMEDICAL</td>
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<td>1.583</td>
<td>2.716*</td>
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<tr>
<td>MULTIDISCIPLINARY SCIENCES</td>
<td>1</td>
<td>0.603</td>
<td>1.73*</td>
</tr>
<tr>
<td>ISI UNRANKED</td>
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<tr>
<td>Total:</td>
<td>59</td>
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</table>

*Institute median impact is greater than ISI median impact
ERA Journal Ranking Analysis

Excellence in Research for Australia (ERA) is an assessment of research quality developed by the Australian Research Council (ARC). In 2010, ARC conducted the first full Excellence in Research for Australia (ERA) evaluation across specified research disciplines. The ARC compiled a list of journals that are included in an annual review and initially stated that these journals would be ranked using the following “four tiers of quality rating”:

- **A* (top 5%)**
- **A** (next 15%)
- **B** (next 30%)
- **C** (next 50%)

<table>
<thead>
<tr>
<th>Field of Research (FOR)</th>
<th>No. Publications for the Institute in this FOR</th>
<th>No. of</th>
<th>% of A or A*</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>A and A*</td>
<td>B</td>
</tr>
<tr>
<td>0905 Civil Engineering</td>
<td>15</td>
<td>9.5</td>
<td>5</td>
</tr>
<tr>
<td>0913 Mechanical Engineering</td>
<td>6</td>
<td>4.5</td>
<td>1</td>
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<tr>
<td>0906 Electrical and Electronic Engineering</td>
<td>3.5</td>
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<td>09 Engineering</td>
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<tr>
<td>0903 Biomedical Engineering</td>
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<td>1.5</td>
<td>1</td>
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<tr>
<td>1005 Communications Technologies</td>
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<td>2.5</td>
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<tr>
<td>12 Built Environment and Design</td>
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<tr>
<td>0904 Chemical Engineering</td>
<td>1</td>
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<tr>
<td>0203 Classical Physics</td>
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<tr>
<td>0802 Computation Theory and Mathematics</td>
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<tr>
<td>04 Earth Sciences</td>
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<tr>
<td>0404 Geophysics</td>
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<td>1</td>
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<tr>
<td>1109 Neurosciences</td>
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<td>0.5</td>
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<tr>
<td>0499 Aerospace Engineering</td>
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<tr>
<td>1202 Building</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
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<tr>
<td>1503 Business and Management</td>
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<tr>
<td>1103 Clinical Sciences</td>
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<tr>
<td>1702 Cognitive Science</td>
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<tr>
<td>0907 Environmental Engineering</td>
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<tr>
<td>1106 Human Movement and Sports Science</td>
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<tr>
<td>0912 Materials Engineering</td>
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<td>0.5</td>
<td>0</td>
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<tr>
<td>0499 Other Earth Sciences</td>
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<tr>
<td>No Ranking</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>59</strong></td>
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</tbody>
</table>

In 2013, more than 70% of submitted IIE journal papers were ranked in A/A* journals for the subject area. The number of A or A* journals increased by 20% from 2012.

*Whilst the ARC no longer uses this tiered ranking system for ERA evaluation, it is remaining a useful measure of journal quality.*
4.4 Higher Degree Research

The total number of Postdoctoral Research Fellows in 2013 was four and they were Dr Kwok Chung, Dr Tianyi Song, Dr Ken Tokeshi, Dr Yu Zhang. In total they have produced 27 publications. The number of publications produced from Postdoctoral Research Fellows increased by 40% from 2012.

Higher Degree Research candidates in 2013 were supported through the Research Training Scheme (RTS). Postdoctoral fellows in the Institute were supported through Australian Research Council (ARC) grants as well as the University of Western Sydney (UWS) Internal Research Grant Schemes.

The total number of Higher Degree Research (HDR) candidates in 2013 was nine; two of these were commencing candidates, four candidates transferred to University of New South Wales. In total, they have produced six publications.

Details of 2013 research higher degree candidates formally enrolled in the Institute, as well as the stipend scholarships held by such candidates:

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Centre Research Area</th>
<th>Degree</th>
<th>Scholarship Award</th>
<th>Commencement (month/year)</th>
<th>Expected Completion (month/year)</th>
<th>Principal Supervisor</th>
<th>Load (FT/PT)</th>
<th>FT=1 PT=0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr Mohamed Ghannam</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>IPRS</td>
<td>Mar-11</td>
<td>Mar-15</td>
<td>Professor Zhong Tao</td>
<td>1</td>
<td></td>
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<tr>
<td>Mr Kamrul Hassan</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>IPRS</td>
<td>Jan-12</td>
<td>Jan-16</td>
<td>Professor Zhong Tao</td>
<td>1</td>
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<tr>
<td>Mr Brendan Kirkland</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>APA</td>
<td>Jan-08</td>
<td>Mar-13</td>
<td>Professor Zhong Tao</td>
<td>1</td>
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</tr>
<tr>
<td>Mr Steven Lamb</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>ARCDP</td>
<td>Apr-10</td>
<td>Apr-14</td>
<td>Professor Kenny Kwok</td>
<td>1</td>
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<tr>
<td>Mr Madhi Moosazadeh</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>IIE</td>
<td>Aug-13</td>
<td>Aug-17</td>
<td>Associate Professor Sergiy Kharkivsky</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mr Ali Razzazzadeh</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>ARCDP</td>
<td>Jul-12</td>
<td>Jun-16</td>
<td>Professor Zhong Tao</td>
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<tr>
<td>Mr Kwokshing Wong</td>
<td>Engineering (Civil)</td>
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<td>Apr-16</td>
<td>Professor Kenny Kwok</td>
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<tr>
<td>Mr Mohammad Yousef</td>
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<td>PhD</td>
<td>ARCDP</td>
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<td>Mar-13</td>
<td>Professor Zhong Tao</td>
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<tr>
<td>Mr Xin Yu</td>
<td>Engineering (Civil)</td>
<td>PhD</td>
<td>IIE</td>
<td>Mar-13</td>
<td>Mar-17</td>
<td>Professor Zhong Tao</td>
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</tr>
</tbody>
</table>
4.5 Honours Research

The IIE offered Honours scholarships (a tax-free stipend of $5,000) for students who wish to undertake a Bachelor of Engineering (Honours) program in a field of research related to Infrastructure Engineering. In 2013, IIE recruited five new Honours students. Their research topics cover all Program Themes in the IIE.

<table>
<thead>
<tr>
<th>Name</th>
<th>Commencement</th>
<th>Supervisor/Supervisors</th>
<th>Thesis title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark Cremona</td>
<td>February</td>
<td>Dr Olivia Mirza, Professor Kenny Kwok, Dr Yaping He</td>
<td>Numerical Investigation on the impact of bush-fire enhanced wind on building structures</td>
</tr>
<tr>
<td>Dane Griffin</td>
<td>February</td>
<td>Dr Olivia Mirza, Professor Kenny Kwok</td>
<td>Design of composite steel-concrete planks for track supports</td>
</tr>
<tr>
<td>Robert Nujjar</td>
<td>February</td>
<td>Prof Zhong Tao</td>
<td>Performance of concrete-filled stainless steel tubular columns in fire</td>
</tr>
<tr>
<td>Isaac Pogson</td>
<td>February</td>
<td>Dr Won Hee Kang</td>
<td>Reliability based capacity reduction factor calibration of CFST members</td>
</tr>
<tr>
<td>Alex Cutts</td>
<td>February</td>
<td>Prof Zhong Tao</td>
<td>Bond between stainless steel tube and concrete in concrete-filled stainless steel columns under elevated temperatures.</td>
</tr>
</tbody>
</table>

One journal publication was produced from 2012 Honours Student – Ms Alyce Kliese under the supervision of Dr Wonhee Kang.

Honours Students Awarded 2013 University Medals

Congratulations to Matthew James Griva (Bachelor of Engineering (Civil), and Kathryn Marika Wilkins (Bachelor of Engineering (Advanced) (Civil) who were awarded a University Medal at the 2013 Spring Graduation Ceremony. University Medals are awarded each year to UWS graduands who achieved consistently high results throughout their studies. During the 2013 Spring Graduation Ceremonies, more than 2000 students received their degrees – an elite group of just eight graduands were presented with a prestigious University Medal in recognition of academic excellence.

Matthew Griva undertook his Honours Project within IIE in 2012 under the supervision of Professor Zhong Tao and Dr Fidelis Mashiri. His Honours Thesis Title was “The behaviour and design of composite columns coupling the benefits of high strength steel and high strength concrete for large scale infrastructure”.

Kathryn Wilkins undertook her Honours Project within IIE in 2012 under the supervision of Dr Olivia Mirza. Her Thesis Title was “Behaviour and design of composite steel-concrete beams with different degrees of shear connections when subjected to fire”.

Kathryn Wilkins, IIE 2012 Honour Student

Matthew Griva, IIE 2012 Honour Student
4.6 Events

There were 26 research seminars presented in 2013, with five of these presenters from overseas institutions.

Institute for Infrastructure Engineering Annual Conference 2013

The Institute for Infrastructure Engineering hosted the Annual Conference on Friday 29 November 2013 at Holiday Inn, Parramatta. The Conference showcased the latest research work carried out by Institute staff and School-based Researchers. Key topics aligned with the four IIE research themes: Infrastructure Systems, Infrastructure Materials, Infrastructure Computations and Infrastructure Health Monitoring.

There was a total of twenty presentations with five presentations for each theme. Four keynote speakers are internationally renowned in their field.

Keynote Speakers:

Professor Bijan Samali
Professor of Structural Engineering, IIE, UWS
“Application of Smart Façade Systems in Reduction of Wind Induced Structural Response”.

Professor Lin-Hai Han
Head of Department, Department of Civil Engineering, Tsinghua University, China
“New Developments on Concrete-Filled Steel Tubular Structures”

Professor Emeritus Robert Meroney
Civil and Environmental Engineering, Colorado State University, USA
“Containment of Fire and Smoke in Building, Urban, and Wild Land Spaces”

Schlumberger Endowed Professor Reza Zoughi
Electrical and Computer Engineering Department, Missouri University of Science & Technology, USA
“Evolution of Microwave and Millimeter Wave Imaging for NDE Applications”
School of Computing, Engineering & Mathematics & Institute for Infrastructure Engineering Joint Research Futures Postgraduate Forum

The School of Computing, Engineering and Mathematics (SCEM) & Institute for Infrastructure Engineering (IIE) Joint Research Futures Postgraduate Forum was held on 4-6 June 2013 at Penrith (Werrington South) Campus. The Forum opened with a welcome from the Dean of School, Professor Simeon Simoff and Director of IIE, Professor Kenny Kwok. The Opening Address was by the Associate Pro Vice Chancellor (Research) Professor Deborah Sweeney and a panel discussion entitled ‘Students and Academic Perceptions on PhD and M-Hons’.

Over the three days, there were four workshops, student session presentations, panel interviews and the 3 Minute Thesis competition.

During the Forum, HDR students from IIE gave a 10-minute presentation of their thesis and the topics were following:

**Steve Lamb** – A longitudinal study of the effects of wind-induced building motion on tall building occupants

**Kwok-Shing Wong** – Effects of wind-induced tall building vibrations on tracking task performances

**Ali Razazzadeh** – Heat transfer analysis of hybrid stainless-carbon steel beam-column joints

**Mohammad Yousuf** – Utilising high performance steels for critical infrastructure protection against extreme loads

**Brendan Kirkland** – Composite steel-concrete beams subjected to axial load

**Kamrul Hassan** – Behaviour of hybrid stainless-carbon steel composite beam-column joints

**Mohamed Ghannam** – Experimental fire tests of concrete filled stainless steel columns

During the Forum students from the SCEM and IIE competed in a Three Minute Thesis Competition. Kamrul Hassan was selected from IIE to compete in the Competition.

**Three Minute Thesis Competition** is a research presentation competition developed to challenge PhD students to communicate their thesis topic to an audience in just three minutes.

The Dean Prof. Simeon Simoff presented the Best Presentation Prize Certificate together with a $200 UWSCloneConnect Book Voucher to the four winners. Steve Lamb, HDR student from IIE was awarded one of the Best Presentation Prizes of the 2013 Forum.

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From left: Dr Darren Walton, Prof Vaughan Macefield, Kwok-Shing Wong, Steve Lamb, Prof Kenny Kwok

Steve Lamb, IIE HDR Student
5.1 Overview of growth – in staffing

Since the establishment of the IIE in 2012, the Institute has increased both in activity and in staffing, with four new members joining the Institute in 2013. Professor Bijan Samali was appointed to the position of Professor of Structural Engineering & Program Director – Infrastructure Systems. Dr Yu Zhang was appointed to the position of Postdoctoral Research Fellow – Infrastructure Computations. Ms Sally Ji was appointed as Research Assistant and Ms Summer Luo as Research Officer. These appointments have assisted to increase Institute staff capabilities and capacity.

New Staff at IIE

We are pleased to introduce the following staff, new to the IIE team:

Dr Yu Zhang
Postdoctoral Research Fellow – Infrastructure Computations
21 November 2013

Dr. Yu Zhang gained his PhD in Mechanical Engineering at Tsinghua University, China in 2003. From 2003 until 2005 he was working in the Institute of Mechanics, Chinese Academy of Science (CAS) as a Postdoctoral Fellow. From 2005-2007 he was performing his research at Purdue University, USA, as a visiting scholar. From 2007-2010 he was working in the Institute of Mechanics, CAS as a Research Associate Professor. In 2010 he moved to Australia and was working at Macquarie University as a Research Fellow.

Sally Ji
Research Assistant
15 July to 14 November 2013

Sally was working on the IIE Research Grant Scheme Research Project titled “Probabilistic Condition Assessment for Smart Management of Water Pipe Networks”.

Professor Bijan Samali
Professor of Structural Engineering
18 November 2013

Professor Samali’s main areas of research include Structural dynamics and its applications to wind and earthquake engineering and blast loading (in particular structural vibration control caused by environmental loads) and more recently dynamic assessment and health monitoring of bridges and smart building facades as well as special performance concrete.

Summer Luo
Research Officer
9 September 2013

Ms Summer Luo is working on the UWS Partnership Research Project titled “Monitoring, Evaluation and Control of Ship Motions for Offshore Infrastructure Construction”.

Sally Ji
Research Assistant
5.2 Funding Overview

The total research income and RIF funding for the institute in 2013 was $3,323,092.

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australian Competitive Grants (ACG)</strong></td>
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</tr>
<tr>
<td>ARC Discovery Projects</td>
<td>219,881.00</td>
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<tr>
<td>ARC Future Fellowships Scheme</td>
<td>97,935.00</td>
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<tr>
<td><strong>Total Australian Competitive Grants</strong></td>
<td>317,816.00</td>
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<tr>
<td><strong>External Grants</strong></td>
<td>36,413.00</td>
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<tr>
<td><strong>Total External</strong></td>
<td>354,229.00</td>
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</tbody>
</table>

**Performance Based Funding**

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOT RIF</td>
<td>1,318,863</td>
</tr>
<tr>
<td>RTS</td>
<td>700,000</td>
</tr>
<tr>
<td>RIBG</td>
<td>375,000</td>
</tr>
<tr>
<td>SRE</td>
<td>175,000</td>
</tr>
<tr>
<td>JRE</td>
<td>400,000</td>
</tr>
<tr>
<td><strong>Total Performance Based Funding</strong></td>
<td>2,968,863</td>
</tr>
</tbody>
</table>

**Overall Total**

$3,323,092

5.3 Disseminations Overview

IIE members were involved in many areas of dissemination of their research in 2013. IIE members published 59 papers in journals and 84 papers in international conferences. In addition to this, senior IIE members hold roles on Australian and International Standards committees and Association Boards which allows for dissemination and practical implementation of their research outputs.
5.4 Grants, Awards and Recognition

External Grants

Linkage infrastructure, equipment and facilities
via University of Wollongong
Title: National Facility for Cyclic Testing of High-Speed Rail
Total $900,000

National Facility for cyclic testing of high-speed rail: Frontier technologies in rail transport demand access to state-of-the-art testing facilities for track modeling. The proposed national Facility for Cyclic Testing of High-Speed Rail (FCTHSR) is internationally a first-of-its-kind and it will be designed and built in-house for examining an array of Australian ground conditions and integrated track components. This unique facility will offer a national and international hub for industry-driven research and consulting. The project outcomes will propel more Australian researchers to be among the world-leaders of rail technologies providing better solutions to challenging track environments. Prototype testing will ensure safer and cost-effective track designs.

Linkage infrastructure, equipment and facilities
via the University of New South Wales
Title: An Australasian facility for the automated fabrication of high performance bespoke components
Total $500,000

A facility for the automated fabrication of high performance bespoke components: The project will create a new coordinated facility for composites research including modern automated infrastructure. The facility will bring Australia in line with leading international research centres and promote fundamental and applied research into a range of fields including underwater renewable energy systems, space vehicle structures, multifunctional and smart materials and infrastructure capacity extension. The facility will position Australian research for significant international collaboration through endorsement of next-generation manufacturing technology and enable leading outcomes for Australasian science and engineering in aerospace, marine, civil, automotive, renewable energy and primary resources.

Awards

National Prize
Dr Chunwei Zhang received the Second Class National Prize for Progress in Science and Technology from the People’s Republic of China for his research titled “Structural Vibration Control and its Applications”. This is one of the top academic achievements acknowledged by the country. Systematic investigations, including theoretical modelling, experimental verification, control-structure interaction, control strategies and design guidelines development, have been carried out by Dr Chunwei Zhang and his collaborators on Active Mass Driver, particularly the Electromagnetic Driving Mass Damper.

University Medal
Matthew James Griva (Bachelor of Engineering (Civil)) and Kathryn Marika Wilkins (Bachelor of Engineering (Advanced) (Civil)) were awarded a University Medal at the 2013 Spring Graduation Ceremony.

Matthew Griva undertook his Honours Project within IIE in 2012 under the supervision of Professor Zhong Tao and Dr Fidelis Mashiri. His Honours Thesis Title was “The behaviour and design of composite columns coupling the benefits of high strength steel and high strength concrete for large scale infrastructure”.

Kathryn Wilkins undertook her Honours Project within IIE in 2012 under the supervision of Dr Olivia Mirza. Her Thesis Title was “Behaviour and design of composite steel-concrete beams with different degrees of shear connections when subjected to fire”.

Distinguished Publications
In 2013, 32 (more than 70% of total) IIE journal papers were ranked in A/A* for their subject area:

Aslani, F. and Samali, B., 2013, ‘Constitutive Relationships for Self-Compacting Concrete at Elevated Temperatures’, Materials and Structures, published online. (ERA – A)


Liao, F., Han, L. and Tao, Z. 2013, ‘Behaviour of CFST stub columns with initial concrete imperfection: analysis and calculations’, Thin-Walled Structures, vol 70, pp 57-69. (ERA – A)


Tokeshi, K., Leo, C. and Liyanapathirana, S. 2013, ‘Comparison of ground models estimated from surface wave inversion using synthetic microtremors’, Soil Dynamics and Earthquake Engineering, vol 49, pp 19-26. (ERA – A)


5.5 Postgraduate Program Overview including numbers of HDR

The total number of Higher Degree Research (HDR) candidates in 2013 was 9; 2 of these were commencing candidates while 7 were continuing candidates. In addition, four candidates transferred to the University of New South Wales where Professor Brian Uy will remain their principal supervisor.

Distinguished Publications

In 2013, 3 IIE journal papers were ranked in the top 5% (A*/A) for their subject area:


5.6 Collaborative Activity

International

Visit to Turkey, September 2013 – Associate Professor Sergiy Kharkivskiy

A/Prof Sergiy Kharkivskiy visited Turkey in September 2013. During the visit he attended and gave the presentation at the International Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures (SMAR 2013), Istanbul, and visited Istanbul Technical University and Cukurova University, Adana. Istanbul Technical University (ITU) has a well-equipped laboratory in the areas of Structural and Civil Engineering. Initially established in 1970’s and restructured in 1993 with the support of Japanese International Cooperation Agency (JICA), Structural and Earthquake Engineering Laboratory (STEEL) has been a local and worldwide leading laboratory in the area of structural and earthquake engineering, ‘ITU Structural and Earthquake Engineering Laboratory’. Studies carried out at the ITU STEEL has been supported by the Scientific and Technological Research Council of Turkey, NATO, European Union, Japanese International Cooperation Agency, State Planning Organization and Turkish Earthquake Foundation.

The visit to Cukurova University (CU), Adana, included a specially organised seminar, laboratory tours and demonstrations, face-to-face meetings with undergraduate and postgraduate students, and academic staff from CU as well as Adana Science and Technology University (ASTU), Adana, and from Gaziantep University (GU), Gaziantep representing at least three generations. A/Prof Kharkivskiy presented information on the UWS, IIE and IIE Postgraduate Research Scholarships. The discussions with students and academic staff showed a potential for exchange students programs. Adana, one of four capital cities in Turkey, is located in the Mediterranean Sea region.

IIE International Research Initiatives Scheme – visited University of Houston (UoH), TX, USA, November 2013.

Professor Gangbing Song from University of Houston (UoH), TX, USA, visited the IIE in July-August, 2013, while Associate Professor Sergiy Kharkivskiy and Dr Kwok Chung visited UoH in November, 2013.

During his visit to the IIE, Prof Song gave a seminar entitled “Recent Advances in Smart Aggregate Research”, met with IIE academic staff, helped to arrange and test a piezoelectric-based (PB) sensor setup with Smart Aggregates and to conduct preliminary measurements of concrete specimens. The results of measurements of early-age concrete specimens obtained in UoH in the framework of the project were also discussed.
After Prof Song’s visit a systematic experimental investigation into stress wave transmission properties and microwave reflection properties of concrete and mortar specimens with different water-to-cement (w/c) ratios have been conducted in IIE. Dependencies of stress wave transmission energy indicators and microwave reflection coefficients on w/c ratio and effect of coarse aggregates in the specimens were demonstrated. It was shown that the changes of the stress wave transmission and microwave reflection properties have different rates for the concrete and mortar specimens with different w/c ratios when the hydration process proceeded.

During the visit of the IIE delegation (i.e., A/Prof Kharkivskiy and Dr Chung) to the UoH the results of the experimental investigations were presented and discussed at the seminar of the Smart Materials and Structures Laboratory ‘Piezoelectric-based sensor setup testing a concrete specimen’. New signal processing techniques used for these investigations were also discussed. The delegation also had the opportunity to work in the laboratory with a variety of facilities including a 11-foot long I-beam, “hot” and “cold” shape control setups, and electrical devices including function/arbitrary waveform generators, power amplifiers and oscilloscopes. Recent advances in simulation of loaded structures with PB sensors, wireless connection with Smart Aggreagates and imaging using PB sensors were introduced to the delegation.

IIE International Research Initiatives Scheme – visited Dalian University of Technology in China, December 2013.

Dr Won Hee Kang (IIE), Dr Chunwei Zhang (IIE), and A/Prof Yan Yu (Dalian University of Technology, China) have been awarded $15,000 for carrying out the IIE International Research Initiatives Scheme (IRIS) project ‘Development of an on-board decision support system for offshore vessel operations’. This proposed IRIS project initiates an international research collaboration between IIE at UWS and Dalian University of Technology in China aiming to propose successful ARC Linkage and National Natural Science Foundation of China (NSFC) projects. The proposed IRIS project develops an on-board decision support system for offshore vessel operations by conducting experimental tests, theoretical development, numerical simulations, and reliability analyses.
6.1 Organisation and Management

Organisational structure, management arrangements, communication strategies etc.

There are ten academic members in the IIE. Each member possesses a high level of research expertise in the areas of civil/structural, mechatronic, electrical engineering and health monitoring fields. One Professor and one new Postdoctoral Research Fellow and two Research Support Staff were recruited in 2013.

Management

The IIE Management Committee comprises the Institute’s Acting Director/Director of Research, Program Directors, Technical Manager and Institute Coordinator. The Management Committee met eight times in 2013. The Research and Higher Degree Committee for the IIE met five times in 2013.

External Advisory Committee

The IIE Management Committee has proposed potential candidates for the Chair of the External Advisory Committee to the Deputy Vice Chancellor for Research for consideration.

6.2 Other Support

IIE is supported by administrative and technical personnel. It comprises of two part-time administrative staff led by Magdalene Wong-Borgefjord, Institute Coordinator, and five technical staff led by Dr Mithra Fernando, Technical Manager.

6.3 Financial Statement

Financial Statement for the year ended 31 December 2013

<table>
<thead>
<tr>
<th>Income</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BOT</td>
<td>$1,318,863</td>
</tr>
<tr>
<td>RTS</td>
<td>$700,000</td>
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<tr>
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<td>SRE</td>
<td>$175,000</td>
</tr>
<tr>
<td>JRE</td>
<td>$400,000</td>
</tr>
<tr>
<td>Total Income</td>
<td>$2,968,863</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenditure</th>
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<tbody>
<tr>
<td>Academic Staff Salary</td>
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<td>Professional Staff Salary</td>
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<td>Casual Salary</td>
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<td>Other Staff Cost</td>
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<td>Conference Fee</td>
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<td>Business Travel</td>
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<tr>
<td>Software Licence &amp; Services Fees</td>
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<td>Consumables</td>
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<td>Motor Vehicles</td>
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<td>Communication</td>
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<td>Marketing &amp; Promotion</td>
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<td>Scholarships</td>
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<td>Minor Equipment</td>
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<td>Internal Charge-Out</td>
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<td>Major Equipment/Capital</td>
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<td>Total Expenditure</td>
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<tr>
<td>Surplus/Deficit</td>
<td>$33,145</td>
</tr>
</tbody>
</table>
7 APPENDIX

7.1 IIE Research Operational Plan 2013

Preamble
The Institute for Infrastructure Engineering (IIE) was established in 2012 with the broad aims to develop innovative solutions that address the effective design and maintenance of civil infrastructure problems. It is outlined in the IIE Research Plan 2012-2014 that IIE will focus on four research themes:
» Infrastructure Systems (IS)
» Infrastructure Computation (IC)
» Infrastructure Materials (IM)
» Infrastructure Health Monitoring (IHM)

Central to meeting IIE’s broad aims and the University’s research objectives is the maintenance of a vibrant research environment and recruitment of high-performance researchers and PhD candidates, underpinned by the University’s commitment to achieve excellence in research. The IIE Research Plan 2012-2014 defines the following four core objectives for IIE:
» Increase external research income to the University
» Increase the number of fields of research at UWS operating above or well above world standard
» Increase the number and concentration of funded research partnerships
» Ensure UWS attracts and graduates high quality HDR students to its areas of research strength

The year of 2013 was the second to implement the strategies and achieving the objectives set out in the three-year Research Plan. The Research Operational Plan 2013 is developed in alignment with the IIE Research Plan 2012-2014. The research activities outlined in this annual research operational plan will contribute to the implementation of the IIE Research Plan. The vision and objectives in this operational plan aim to be known and implemented by each of IIE staff.

Actions to implement objective 1 of increasing external research income to the University

Introduction:
IIE and its predecessor CRC have made significant contributions to external research income received by the University. IIE’s research strengths and track record are well-placed to enhance IIE’s capacity to successfully attract external research income from national and international competitive research grant schemes, applied research grants and higher level consulting. In 2012, the total external research income attracted by IIE was $667,932.

Actions in 2013:
1. Organise IIE seminar series to foster internal and external research collaborations
2. Organise grant strategy meetings to explore, identify and cultivate collaborative research opportunities that crystallise in grant applications
3. Increase the awareness of the research activity targets set for IIE research staff
4. Recruit high-performing researchers to consolidate IIE strength and capacity, including a professor, a senior lecturer and a Postdoctoral Research Fellow
5. Encourage internal and external researchers to apply for ARC DECRA, FF and Laureate Fellowships to be awarded in 2014
6. Develop the careers of middle and early career researchers by providing internal research funding
7. Increase the availability and suitability of space for our research activities and house IIE staff and HDR students

Performance Measures:
1. Benchmarking against Australian university sector and selective groupings, including number of submitted grants, grants awarded and income generated
2. Success in attracting high-performing researchers with a proven track record
3. Critical mass of each IIE’s research theme

Actions to implement objective 2 of increasing the number of fields of research at UWS operating above or well above world standard

Introduction:
IIE and its predecessor CRC’s primary field of research is in civil engineering (Field of Research Code (FoR) 0905) for which the University achieved a rating of 4 (above world standard) in the 2010 round of ARC ERA. In the recent round of ARC ERA 2012, UWS was ranked a 4 (above world standard) out of a maximum 5 in Mechanical Engineering (FoR code 0913), and a 3 (at world standard) out of a maximum 5 in Civil Engineering (FoR code 0912), Electrical and Electronic Engineering (FoR code 0906) and Material Engineering (FoR code 0912). It is expected that IIE will further enhance UWS’s capabilities in the areas of Civil, Electrical, Materials and Mechanical Engineering (FoR codes: 0905, 0906, 0912 and 0913), and strengthen its contribution in the next round of ARC ERA 2015.
Actions in 2013:

1. Identify research priorities for each IIE research theme.
   » Infrastructure Systems: monitoring, evaluation and control of ship motions for offshore infrastructure construction; probabilistic condition assessment for smart management of water pipe networks; risk assessment and management of water supply networks; hybrid stainless-carbon steel composite beam-column joints
   » Infrastructure Computations: characterisation of bushfire-enhance wind and its effects on buildings; characterisation of transient flows in complex terrain; development of a transient flow simulator; evaluation of green building features on urban ventilation and air quality enhancement; human response to wind-induced building motion
   » Infrastructure Materials: fire-resistant concrete; expansive concrete; passive confinement of concrete by steel tubes and/or FRP; post-fire behaviour of stainless steels; and fire performance of blind bolts
   » Infrastructure Health Monitoring: microwave antennas and sensors; wireless power transmission in concrete; development of an integrated high-frequency wideband imaging system; microwave imaging of composite structures, piezoelectric-based sensors.

2. Recruit high-performing researchers to consolidate strength and capacity to generate assessable output for FoRs 0905, 0906, 0912 and/or 0913

3. Ensure 100% research efforts made in areas of research concentration

4. Organise publication strategy meetings in IIE

5. Provide funding in building world class lab facilities

6. Invite world leaders to visit IIE and allocate fund for visiting top universities

7. Provide funding to allow all research staff to attend at least one professional conference annually

8. Mentor and nurture junior research staff on research

Performance Measures:

1. Maintain and enhance assessable output for FoR 0905; benchmark against Australian university sector and selective groupings for assessable output in FoR 0905

2. Boost assessable output for FoRs 0906, 0912 and 0913; benchmark against Australian university sector and selective groupings assessable output for FoRs 0906, 0912 and 0913

3. Enhance both the quantity and percentage of publications in the most highly ranked outlets, typical of the publication profile of ERA groupings ranked at level 5.

4. Impact of publications as measured by citations, awards and other recognition methods

Actions to implement objective 3 of increasing the number and concentration of funded research partnerships

Introduction:

IIE has established strategic and productive research collaboration with a sizable number of local and international universities, research centres/institutes and other government, professional and industry partners through research projects funded by a variety of funding agencies. IIE is well-placed to consolidate these existing partnerships and establish new strategic research partnerships with other research, professional and industry partners.

Actions in 2013:

1. Prepare IIE promotional materials to improve the visibility of IIE

2. Publish and distribute the IIE annual newsletter

3. Redesign IIE’s website to improve navigation and increase the information on the website

4. Promote/market the unique IIE facilities

5. Provide seed funding that promotes the establishment of strategic research partnerships

6. Organise IIE annual conference and invite industry partners and research collaborators

Performance Measures:

1. Number of submitted grants, grants awarded and income generated from new research partnerships

2. Research and other collaborative activities such as research seminars and reciprocal visits by research partners

Actions to implement objective 4 of ensuring UWS to attract and graduate high quality HDR students to its areas of research strength

Introduction:

IIE is committed to maintain a vibrant research environment to attract local and international HDR candidates. In 2012, IIE hosted 11 HDR candidates who were holders of a variety of competitive scholarships including APA, IPRS, ARC DP and ARC LP scholarships. Due to the resignation of Prof. Brian Uy, 4 PhD students will be transferred to the University of New South Wales in 2013.
**Actions in 2013:**

1. Provide up to 5 IIE postgraduate research scholarships to attract high quality PhD candidates
2. Advertise IIE scholarships and maximise opportunities for HDR recruitment
3. Include the information of APA awards on the IIE’s website to encourage potential students to apply for the awards to study in IIE
4. Encourage UWS Honours students to apply for APA awards
5. Implement current policies and procedures for ensuring satisfactory research student progress and supervision, and implement innovations to enhance the HDR experience.
6. Provide funding to allow all HDR students to attend and present one international and one domestic conferences during their candidature

**Performance Measures:**

1. Award of IIE postgraduate research scholarships
2. Award of Australian Postgraduate Awards and ARC scholarships
3. Number of HDR students supervised per FTE member of academic staff at Levels B and above
4. PhD completions
5. Articles published in high quality research journals or conference proceedings by IIE HDR students

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**7.2 Staff List in 2013**

**Academic Staff**

- Professor Kenny Kwok – Acting IIE Director, Director of Research, Program Director Infrastructure Computations
- Professor Bijan Samali – Program Director Infrastructure Systems
- Professor Zhong Tao – ARC Future Fellow and Program Director Infrastructure Materials
- Associate Professor Sergiy Kharkivsky – Program Director Health Monitoring
- Dr Chunwei Zhang – Senior Lecturer, Structural Control
- Dr Won Hee Kang – Lecturer, Structural Reliability
- Dr Ken Tokeshi – Postdoctoral Research Fellow
- Dr. Yu Zhang – Postdoctoral Research Fellow Infrastructure Computations
- Dr. Kwok Chung – Career Development Fellow Infrastructure Health Monitoring
- Dr Tian Yi Song – Postdoctoral Research Fellow

**Administrative Staff**

- Magdalene Wong-Borgeford – Institute Coordinator
- Rachel Stoddart – Administrative Officer (part-time 0.6)
- Emma Carey – Administrative Officer (part-time 0.4)

**Technical Staff**

- Dr Mithra Fernando – Technical Manager
- Robert Marshall – Project Manager
- Nathan McKinlay – ICT Professional Officer
- Murray Bolden – Technical Officer
- Ranjith Ratnayake – Technical Officer
- Mitch Quirk – Technical Trainee
7.3 Visiting Scholars in 2013

Emeritus Professor Robert Meroney from Colorado State University, USA visited IIE in November 2013.

Dr. Meroney has had over fifty years of experience in teaching and research on basic and applied problems of fluid mechanics. He has conducted research in atmospheric transport, toxic and flammable gas spills, fossil and nuclear power plant siting, wind power, urban air pollution environments, ventilation in buildings, movement of fire and smoke, drying in porous media, sludge collectors, settling basins, drift from cooling towers and wind engineering.

He worked with Professor Kenny Kwok for the IRIS project, presented a keynote lecture at the IIE Annual Conference. Emeritus Professor Meroney also gave two research seminars at IIE; (1) Fire Whirls, Fire Tornadoes and Firestorms: Physical and Numerical Modeling, (2) CFD Prediction of Dense Gas Clouds Spreading in a Mock Urban Environment.

Professor Gangbing Song, Director, Smart Materials and Structures Laboratory, Professor, Department of Mechanical Engineering, Professor, Department of Civil and Environmental Engineering, Professor, Department of Electrical and Computer Engineering from the University of Houston, USA visited the IIE in August 2013.

Dr. Song is a recipient of the NSF CAREER award in 2001. He has published more than 300 papers, including 120 peer reviewed journal articles. Dr. Song is also an inventor or co-inventor of 4 US patents and 8 pending patents. He received the prestigious Outstanding Technical Contribution Award from the Aerospace Division of ASCE, the Excellence in Research & Scholarship Award at Full Professor Level from UH, the Celebrating Excellence Award for Excellence in Education from ISA (International Society of Automation), the IEEE Educational Activities Board Meritorious Achievement Award in Informal Education, among others.

Professor Song worked with Associate Professor Sergiy Kharkivsky and Dr Kwok Chung for the IRIS project and also gave a research seminar on “Recent Advances in Smart Aggregate Research”.

Associate Professor Yan Yu, Deputy Director of Sensors Institute, School of Electronic Science and Technology, Dalian University of Technology China visited the IIE in August 2013.

Associate Professor Yu obtained his PhD in Disaster Prevention and Reduction Engineering in 2006 from Harbin Institute of Technology. His research interests include wireless sensor network, data fusion, structural health monitoring and intelligent building.

Associate Professor Yu worked with Dr Chunwei Zhang and Dr Wonhee Kang for the IRIS project and gave a research seminar on “Design, Calibration and Some Applications of Wireless Sensors and Their Networks for Structural Health Monitoring of Civil Infrastructures”.

Professor Gangbing Song with Sergiy Kharkivsky

Professor Yan Yu with Chunwei Zhang

Prof Robert Meroney with Bijan Samali
7.4 Academic Staff Profiles

**Professor Kenny Kwok**
Acting Director – 2013  
Director of Research  
Program Director  
Infrastructure Computations

**Background**
Professor Kwok is Acting Director and Program Director (Infrastructure Computations) in the Institute of Infrastructure Engineering at University of Western Sydney (UWS). From 1999-2005, he was a member of the Engineering Panel of Research Grant Council of Hong Kong, and in 2010 and 2012, he served as a member of Engineering and Environmental Sciences Research Evaluation Committee, Excellence in Research for Australia, Australian Research Council.

From 1998-2008, he was a Professor of Civil Engineering and Director of the CLP Power Wind/Wave Tunnel Facility at the Hong Kong University of Science and Technology. At the University of Sydney (1977-2002), he held the positions of Professor of Wind Engineering, Associate Dean of Engineering, Director of Wind Engineering Services, and Director of Graduate School of Engineering. Professor Kwok is currently the Asia-Oceania Regional Coordinator and member of the Executive Board of the International Association for Wind Engineering.

**Research/Teaching Expertise**
Professor Kwok’s main research interests and technical expertise are wind engineering and structural dynamics, particularly wind effects on buildings and structures, wind tunnel tests, environmental fluid mechanics, vibration control and occupant comfort assessment. He has published over 400 articles in book chapters, invited and keynote papers, journal and conference papers.

He has been awarded more than $4.5 million in research grants and undertaken wind engineering consultancy projects in Australia, Hong Kong and other countries worth over $3 million. He is the editorial board member of three international journals in wind engineering and structural engineering. He is currently Chairman, of ASCE/SEI Subcommittee on Human Perception of Motion, a member of ASCE/SEI Technical Committee on Tall Buildings, a member of BD006-02 on wind loading code AS/NZS 1170.2, and a Scientific Advisor to the Hong Kong Observatory.

**Grants/Projects**

National Facility for Physical Blast Simulation (NFPBS) (Uy, Zhang, Kwok, Remennikov, Hao, Ma, Thambiratnam, Stewart, Wu, Mendis) Australian Research Council Linkage Infrastructure, Equipment and Facilities Funding (LE130100133), 2013, ($400,000).
Professor Bijan Samali
Program Director
Infrastructure Systems

Background
Professor Samali is Professor of Structural Engineering and Program Director – Infrastructure Systems. He was appointed to the position in 2013. Prior to joining UWS, Professor Samali held a Personal Chair in Structural Engineering since 1999. He is the author or co-author of over 430 scholarly publications (including over 100 journal publications), on a wide range of topics in the areas of structural engineering, structural dynamics, vibration and motion control, wind and earthquake engineering, bridge engineering, damage detection and health monitoring of structures including keynote addresses and invited papers. He has also been involved with several major projects as a specialist consultant over the years. He received his Doctor of Science (DSc) degree in Structures and Dynamics from George Washington University, USA in 1984.

Research/Teaching Expertise
Professor Samali’s research interests include:
» Structural Dynamics, Earthquake Engineering, Wind Engineering
» Analytical and experimental investigation of active, semi-active and passive control devices to reduce dynamic response of structures subjected to severe wind and seismic loading using computer simulation and shake table and wind tunnel testing
» Structural Dynamics, Earthquake Engineering, Wind Engineering
» Use of smart materials in structural control applications, particularly MR and ER fluids
» Study of seismic performance of low cost mud brick and stone buildings and their strengthening in developing countries
» Determining in-service conditions and load rating of timber, concrete and steel bridges using dynamic testing techniques
» Damage detection and health monitoring of bridges, electricity power poles and other structures
» Soil-Structure Interaction due to seismic loading – buildings with either raft or pile foundations
» Cost effective assessment techniques for management of timber bridges
» Retrofitting of under-strength or damaged concrete structures by fiber reinforced composites
» Impact of blast loads on building façade systems
» Effect of extreme loads such as blast, wind and earthquake loads on cable-stayed bridges
» Development of a new generation of Safe, Secure and Energy Efficient Multi-Skin façade system

Grants/Projects
ARC (Linkage Grant) and Energy Australia – Determination of the Condition and Strength Capacity of In-Service Timber Poles in Energy Networks).
ARC (Linkage Grant) and Permasteelisa Pty Ltd – A Holistic Integrated Design Approach for Building Envelopes Incorporating Sustainability, Security and Safety ($642,106).
Background

Professor Zhong Tao is one of Australia’s first Future Fellow’s, awarded by the Federal Government in 2009. He joined UWS in 2007 and is currently a Professor, Program Director for Infrastructure Materials and Honours Co-ordinator in the IIE. He obtained his Bachelor degree from Zhengzhou Grain College in 1993 and his Master’s degree from Harbin University of Civil Engineering and Architecture in 1998. He studied at Harbin Institute of Technology and received his PhD in 2001. Before joining UWS, Professor Tao held the position of Professor of Structural Engineering at Fuzhou University, China.

Research/Teaching Expertise

Professor Tao has a research background in the area of steel-concrete and FRP composite structures. He has published extensively, including two books, 53 international journal papers and 69 Chinese journal papers. Zhong has been a fundamental player in technology transfer activities, through his role in drafting five local or national design codes in China. He was awarded five patents by the Chinese National Bureau of Knowledge Property Right before he moved to Australia. He has received numerous awards and prizes for his contributions to the research and application of steel-concrete composite construction. He has been successful in attracting competitive research grants both in Australia and China with a total over AUD $2.1 million. He has supervised over 50 higher degree research students. Zhong currently serves on the Editorial Board of Steel and Composite Structures (Techno Press).

Grants/Projects

Hybrid stainless-carbon steel composite beam-column joints at ambient and elevated temperatures, (Tao and Han), Australian Research Council-Discovery Grant, 2012-2014, ($430,000).

The behaviour and design of composite columns coupling the benefits of high strength steel and high strength concrete for large scale infrastructure, (Uy, Tao, Mashiri, Liew and Han), Australian Research Council-Discovery Grant, 2012-2014, ($400,000).

Behaviour and design of concrete-filled stainless steel tubular columns at ambient and elevated temperatures, (Tao), Australian Research Council-Future Fellowships Scheme, 2009-2013, ($686,000).

Cyclic behaviour of RC shear walls framed with concrete-filled steel tubes, (Tao, Liao and Han), National Natural Science Foundation of China, 2007-2009, CNY 260,000.
Associate Professor Sergiy Kharkivsky
HDR Director
Program Director
Infrastructure Health Monitoring

Background
Associate Professor Sergiy Kharkivsky (professional name is Sergey Kharkovsky) joined UWS in 2011. He received his Diploma in Electronics Engineering from Kharkov National University of Radioelectronics, Ukraine, in 1975, his Ph.D. from the Kharkov National University, and D.Sc., in Radiophysics from the Institute of Radio-Physics and Electronics (IRE) of National Academy of Sciences of Ukraine. From 1975-1998, he was a Member of the Research Staff at IRE, and then Professor in the Electrical and Electronics Engineering Department at the Cukurova University, Adana, Turkey until 2003. From 2003-2011, he was Research Associate Professor in the Applied Microwave Non-destructive Laboratory (amntl) in the Electrical and Computer Engineering Department at Missouri University of Science and Technology, Rolla, USA.

Associate Professor Kharkivsky has authored and co-authored more than 120 publications in the microwave and millimeter wave physics and engineering, material characterization and non-destructive evaluation, and he has 11 USSR patents and 4 US patents in his credit.

Research/Teaching Expertise
Microwave and millimeter physics and engineering, sensor technologies, non-destructive evaluation and imaging of composite structures, structural health monitoring, material characterization, and instrumentation and measurement.

Grants/Projects
Dr. Chunwei Zhang joined UWS in 2011. Prior to joining UWS, he was Associate Professor of Civil Engineering and Ph.D. supervisor of Mechanics at Harbin Institute of Technology (HIT), China. From 2006-2010, he was Deputy Director for the Laboratory of Blast Resistance & Protective Engineering at HIT. He received his Bachelor’s Degree from Harbin University of Civil Engineering and Architecture with the top grade award (equivalent to First Class Honours) in 1999. He received Master’s Degree and Ph.D. from HIT in 2001 and 2005, respectively.

He has served as the Secretary-General for Young Researcher’s Forum at the 14th World Conference on Earthquake Engineering. Committee member of Dynamics and Control Division of American Society of Civil Engineer (ASCE), and Executive or Steering member for several international symposia and academic associations. He is the reviewer for Australian Research Council (ARC), the National Science Foundation of China (NSFC), and a number of international journals and conferences. He has been awarded the first grade prize for Science and Technology Progress by the Ministry of Education of China in 2009, the Japan Society of Seismic Isolation (JSSI) award in 2004, and a number of awards from provincial Government and Ministry Departments in China.

Research/Teaching Expertise
Dr Zhang’s research interests include structural control, blast and impact, protective engineering, disaster mitigation for energy engineering and offshore engineering. He has received a number of national competitive research grants from ARC, NSFC, and the Ministry of Science and Technology (MoST) of China. He has also established linkages with industry. He has published one book, one book chapter, over 90 referred journal and conference papers, successfully applied five patents and involved in three design code chapters.

Grants/Projects
Uy, Zhang, Kwok, Remennikov, Hao, Ma, Thambiratnam, Stewart, Wu, Mendis. National Facility for Physical Blast Simulation (NFPBS), ARC LIEF130100133, 2013, $400,000.
Wu, Guan, and Zhang. Earthquake Damage and Control of Urban Infrastructures, China Ministry of Science and Technology, National Major Fundamental Program No. 2007CB714204, 2007.7-2011.8:$750,000.
Dr Won Hee Kang
Lecturer
Structural Reliability

Background
Won Hee Kang joined UWS as a Lecturer in Structural Reliability in March 2011. He obtained a Bachelor Degree from Korea University (Architectural Engineering, 2004), and a Masters and Ph.D. from the University of Illinois at Urbana-Champaign (Civil and Environmental Engineering, 2006 and 2011). His research has been focused on the development and application of novel system reliability methods and the calibration of capacity factors in current Australian design code provisions.

Research/Teaching Expertise
Dr. Kang has research interests in the development of system reliability analysis methods, post-hazard risk assessment of complex infrastructure networks, stochastic damage detection of lifeline systems, and reliability-based calibration of capacity reduction factors. His previous and ongoing research topics include the probabilistic condition assessment for smart management of water pipe networks; monitoring, evaluation and control of ship motions for offshore infrastructure construction; the development of system reliability analysis methods; damage detection of water networks based on stochastic inference; calibration of capacity factors of CFST members and steel members based on Australian Standard; planning for drought preparedness in the watershed context; risk-based decision analysis; system reliability assessment for risk-quantified designs of heavy machines; systematic treatment of uncertainties in consequence-based earthquake engineering; and probabilistic shear strength models for RC beams.

His teaching at UWS includes lecturing 300717 Egress and Risk Assessment and tutoring 200472 Material Science in Construction and 300463 Fundamentals of Mechanics.

Grants/Projects
Risk assessment and management of water supply networks, funded by Yeon Kyoung Foundation in Korea, (Kang W-H), Jan-Dec 2013, ($5,000).


Dr Ken Tokeshi
Career Development Research Fellow

Background
Dr. Tokeshi joined UWS as a Postdoctoral Research Fellow in 2010. In 2012 he was appointed as a Career Development Fellow in the IIE. Dr. Tokeshi obtained his PhD at the Tohoku University (Sendai, Japan) in 1999. After working at a Japanese Pile Company in Sendai (Japan) for one year, he moved to the Akita Prefectural University at Yuri-Honjo as Visiting Research Fellow for one year and became a Lecturer during 2001-2008. From 2008 to 2010, he was a Postdoctoral Research Fellow at the Politecnico of Turin.

Research/Teaching Expertise
Dr. Tokeshi has carried out research concerning Earthquake Geotechnical Engineering for more than 20 years. In particular, he has conducted research on the Estimation of Vs Soil Profile and the Assessment of Dynamic Characteristics of the Ground Using Passive Ambient Noise and its Verification Using Wave Propagation. He has worked as Assistant Professor at the Department of Architecture and Building Engineering, Akita Prefectural University for more than 7 years, teaching subjects on Structural Analysis and Soil and Foundations, among others. He has been a reviewer of several journals, such as Soil Dynamics and Earthquake Engineering, Geophysics, Near Surface Geophysics, and Geophysical Prospecting, among others.

Grants/Projects
Experimental and synthetic surface waves dispersion. ($89,000), Grants for Foreign Senior Researcher, Regione Piemonte, Italy, 2008-2010.


Dr Kwok Chung
Career Development Research Fellow, Infrastructure Health Monitoring

Background
Dr Kwok Chung joined UWS in 2013 as a Career Development Research Fellow. He received his Bachelor of Engineering with First-Class Honours and PhD, at the University of Technology, Sydney (UTS), both in Electrical Engineering. Prior to joining UWS, Dr Chung has been a Lecturer in Engineering at UTS and the Hong Kong Polytechnic University since 2004. Dr Chung is an active researcher and has authored and co-authored about 70 publications in the areas of microwave sensors/antennas design and related areas. Dr Chung is a Senior Member of IEEE and serves on the Editorial Boards for a number of international journals.

Research/Teaching Expertise
In teaching, Dr Chung has taught a number of engineering courses at Australian and Hong Kong Universities. His areas of expertise are Electronics and Circuits, Data Acquisition and Instrumentations, Applied Electromagnetics, Antenna and Propagations.

Grants/Projects
Experimental investigations into the response of microwave and piezoelectric-based sensor techniques interacting with cementitious specimens (Kharkovsky, Chung, Song), International Research Initiatives Scheme (UWS IIE), 2013, (AUD $15,000).

Design of High Performance Suspended Patch Antennas with the Use of Particle Swarm Optimization (Chung, Tam – PolyU 5162/09E), GRF, Hong Kong Research Grants Council, Apr 2010–Sep 2011.


Dr Tian-Yi Song
Career Development Fellow, Infrastructure Materials

Dr Song joined UWS in 2012 as a Career Development Fellow – Infrastructure Materials. Dr Song obtained his Bachelor degree in Civil Engineering (Bridge Engineering) in 2003 and his Masters degree in Civil Engineering (Bridge and Tunnel Engineering) in 2006 from Chang’an University in Xi’An, China. He continued his research at Tsinghua University, Beijing, China and received his PhD in Civil Engineering in 2011. Prior to joining UWS, Tian-Yi worked as a Research Fellow at the National University of Singapore from April 2011 to September 2012.

Research/Teaching Expertise
Dr Song’s research interests are in structural fire performance, fire resistance design and fire safety. His main research activities include:

» Fire behaviour and design of concrete-filled steel tube columns;
» Fire behaviour of steel-reinforced concrete members;
» Post-fire behaviour and repairing of steel-concrete composite members and joints under combined loading and temperature histories;
» Experimental testing of steel-concrete composite structures under fire and after exposure to heating and cooling fire;
» Numerical modeling based on finite element analysis software and subroutine.

Grants/Projects
Development of fire-resistant concrete (Song and Tao), Research Grant Scheme, (UWS IIE), 2013, (AUD $25,000).
Associate Professor Richard (Chunhui) Yang
Associate Professor in Mechanical Engineering School Based Researcher of IIE

Background
A/Prof Richard (Chunhui) Yang joined the School of Computing, Engineering and Mathematics in January 2012 as Associate Professor in Mechanical Engineering and Smart Structures. Prior to this, Richard was holding the position of Senior Lecturer in Mechanical Engineering, the School of Engineering, Deakin University (Deakin). Prior to his almost six-year working in Deakin University, he also had worked for a couple of years each in the University of Sydney (USyd) and Korea Advanced Institute of Science and Technology (KAIST) as post-doc research fellow after he finished his PhD in Mechanical Engineering in the University of Hong Kong (HKU) in 2002. He was awarded the Graduate Certificate for Higher Education by Deakin University in 2008.

Research/Teaching Expertise
A/Prof Yang has mainly been working in computational mechanics and its applications in mechanical engineering for about 15 years focusing on characterization of material properties and behaviours via numerical modelling and simulations, i.e., multi-scale modelling of advanced engineering materials and structures, structural health monitoring (SHM) and smart structures, metal forming and metal surface treatment, etc. He has been awarded 2 ARC Linkage grants in roll forming of metal sheets, 1 ARC LIEF on Hybrid testing facility for structures under extreme loads with his colleagues as well as two competitive overseas research grants, including 1 Beijing Natural Science Foundation grant (BNSF) on roll forming and 1 National Science Foundation of China grant (NFSC) on bio-materials with his colleagues from China.

In teaching, he has mostly been involved in the Year-3/4 undergraduate and postgraduate subjects in Mechanical Engineering with bringing teaching innovations and modern technologies into class, i.e. Mechanics of Materials, Dynamics of Machines, Finite Element Analysis, Computer-Aided Engineering, Mechanical Design and Automated Manufacturing, etc. Up to 2012, he has published about 100 journal/conference papers and confidential reports for industrial partners in his research areas. As for external service, he is serving as assessor for ARC, editor board member, conference committee member, reviewers of international journals and conferences, and examiner for Master and PhD thesis, etc.

Research and Teaching Expertise:
» Multi-scale Modelling and Simulations of Advanced Engineering Materials and Structures
» Engineering Numerical Methods and their Applications
» Digital Representation, Fabrication and Characterization of Materials
» Elastic Wave-based Structural Health Monitoring System and Smart Structures
» Metal Forming
» Metal Surface Treatment and Coating
» Nano-composites
» Metal Foams
» Conductive Polymers

Grants/Current Projects
Background
Dr He obtained his first engineering degree from the University of Science and Technology in Beijing, and his PhD from the University of Queensland. He served in a number of institutions and industry before he joined University of Western Sydney in 2004 and is currently heading the School's postgraduate programs including Fire Safety Engineering, Building Surveying and Bushfire Protection. Dr He has vast experience in fire safety engineering research, education as well as consulting. He was a group leader in the Australian Fire Code Reform Centre project, responsible for model development and validation. He participated in the development of the Australian Fire Safety Engineering Guidelines (2nd Ed) and the International Fire Engineering Guidelines.

Research/Teaching Expertise
Dr He’s areas of research and teaching interest include building elements and building occupants’ response to fires, fire dynamics, fire safety engineering design, fire-wind-structure interactions, risk assessment methodology, stochastic modelling, sustainable fire safety engineering design and thermal fluids.

Dr He has developed many methods for developing and assessing alternative building solutions for fire protection.

Grants/Projects
Numerical investigation of bushfire-wind-structure interactions.
Building structure statistical characteristics for fire resistance design.
Reliability of building fire services.
Dr Fidelis Mashiri
Academic Course Advisor Engineering and Construction Management
Senior Lecturer
Civil Engineering, Engineering and Construction Management
Research Collaborator

Background
Prior to joining the University of Western Sydney, Dr Fidelis Mashiri was a lecturer at the University of Tasmania. Before then he was a research fellow at Monash University following the completion of his PhD at the same university. Fidelis has worked as a site engineer on dam projects in Zimbabwe and as a consulting engineer in Chile and Australia. Fidelis is a member of the Institution of Engineers (Australia) and a member of American Society of Civil Engineers (ASCE). He is currently a member of the Australian Standard Committees on Steel Structures, BD-001, Cold-Formed Steel Structures, BD-082 and Security Screen Doors and Window Grilles, CS-023. Fidelis is a member of The Institution of Engineers, Australia (IEAust), the American Society of Civil Engineers (ASCE), the Welding Technology Institute (WTIA) and the Australian Steel Institute (ASI).

Research/Teaching Expertise
Dr Fidelis Mashiri’s research interests are in fatigue and fracture mechanics. He specialises in the fatigue of welded steel connections and has published articles in journals and conference proceedings. Fidelis has worked on research projects that are applicable to the mining, road transport and agricultural industries. Fidelis is a referee of the Journal of Constructional Steel Research (JCSR) and the Thin-Walled Structures journal (TWS). He also regularly reviews papers for several other journals including the Journal of Structural Engineering – ASCE (USA), Journal of Bridge Engineering – ASCE (USA) and the Materials and Structures journal among others. In 2009 Fidelis graduated from the University of Tasmania with a Graduate Certificate in University Learning and Teaching. He also has interests in research in teaching and learning.

Grants/Projects
The behaviour and design of composite columns coupling the benefits of high strength steel and high strength concrete for large scale infrastructure (Brian Uy, Zhong Tao and Fidelis Mashiri), Australian Research Council (ARC), 2012 – 2015.
Concrete Filled VHS-Plate Fabricated Columns (Fidelis Mashiri and Brian Uy), UWS, 2009 – 2012.
Dr Olivia Mirza
Academic Course Advisor
Postgraduate Fire Safety Engineering and Building Surveying

Senior Lecturer
Engineering and Construction Management
School Based Researcher of IIE

Background
Dr Olivia Mirza is a Senior Lecturer in the School of Computing Engineering and Mathematics. She is also Academic Course Advisor for Postgraduate Fire Safety Engineering and Building Surveying Program. She is a representative for Woman in Engineering for Western Sydney Region. Dr Mirza’s PhD research was mostly concentrated on the behaviour and design of shear connectors on composite steel and concrete structures. She has published 2 books, 8 refereed journal papers and 26 conference papers. In order to advance her research and contribute to the engineering community, Olivia is also working closely with industry partners (AJAX Fastener, One Steel, Bluescope and VSL prestressed) and government departments (RMS formerly known as RTA and RailCorp).

Research/Teaching Expertise
Issues emphasised in Dr Olivia Mirza’s research were the effects of steel fibres as a strengthening system in composite steel-concrete beams, the effects of elevated temperatures on the behaviour of headed stud shear connectors for composite steel-concrete beams, the long term effects on the behaviour of the composite steel-concrete beams, the effects of strain regimes on the behaviour of the composite steel-concrete beams, the effects of the combination of axial tension and shear loading on the behaviour of composite steel-concrete beams. Olivia’s research experience is in experimental investigation, numerical analysis, theoretical analysis and design. She has supervised and co-supervised at honours, masters and Doctoral level. Olivia has also taught several undergraduate level units. Olivia’s additional research interests include: Flush end plate for beam-column connection using blind bolt under both static and seismic loading and the use of innovative anchors for the achievement of composite action for rehabilitating existing and deployment in deconstructible and sustainability of composite steel-concrete structures.

Grants/Projects
The use of innovative anchors for the achievement of composite action for rehabilitating existing and deployment of demountable steel structures, 2011-01-01 – 2013-12-31, Brian Uy, Xinquin Zhu and Olivia Mirza, Australian Research Council (ARC), AUD 256, 339.

The Behaviour of post-tensioned composite steel-concrete slabs, Prof. Brian Uy (UNSW), A/ Prof. Gianluca Ranzi (Sydney University), Industry Partners: Stramit Industries and Arup Pty. Ltd., Australian Research Council (ARC).

Testing of existing bridges to take higher axial load, Dr. Sakdirat Kaewunruen, Industry Partners: RailCorp.

Numerical analysis on existing track and bridge interaction under elevated temperatures, Dr. Sakdirat Kaewunruen, Industry Partners: RailCorp.

Fatigue behaviour of existing steel bridge girder, Dr. Almut Pohl, Industry Partners: Roads Maritime Services (RMS) formerly known as RTA.

The effect of prestressing on headed stud shear connectors for composite steel and concrete beams, Industry Partners: VSL Australia.
Dr. Ming Zhao
Senior Lecturer CRM
School Based Researcher of IIE

Background
Dr Ming Zhao joined the University of Western Sydney as a senior lecturer in the School of Engineering in March, 2011. He obtained his Bachelor degree in Engineering from Liaoning Institute of Technology, China in 1993. He was awarded his PhD degree at the State Key Laboratory of Coastal and Offshore Engineering, Dalian University of Technology, China in 2003 and worked in this laboratory as a postdoctoral fellow until 2005. Between 2005 and 2011, he worked in the School of Civil and Resource Engineering, the University of Western Australia as a research associate and then research assistant professor. Ming was awarded two ARC discovery grants as a Chief Investigator and has published over 50 refereed papers in international journals and conferences.

Research/Teaching Expertise
» Computational fluid dynamics
» Fluid structure interaction
» Heat transfer in fluids
» Local scour around subsea structures
» Ocean wave theory
» Turbulent flow
» Vortex induced vibration (VIV)

Grants/Projects


Dr Xinqun Zhu
Senior Lecturer
Structural Engineering
School Based Researcher of IIE

Background
Dr Xinqun Zhu obtained his Bachelor Degree from Zhejiang Sci-tech University in 1987 and a Master’s Degree from Southwest Jiaotong University in 1990. He commenced his studies at the Hong Kong Polytechnic University in 1998 and was awarded a PhD in 2001. He then worked as a research fellow at the University of Manchester, the Hong Kong Polytechnic University, and the University of Western Australia for around 7 years. Currently, he is a Senior Lecturer in Structural Engineering at UWS.

He is a member of the American Society of Civil Engineers (ASCE), the Executive Committee of Australian Network of Structural Health Monitoring and the Structural Health Monitoring and Control Committee in Engineering Mechanics Institute of ASCE.

Research/Teaching Expertise
Dr Xinqun Zhu has published over 130 articles with a Scopus-h index of 16. His research interests are primarily in structural dynamics, especially in structural health monitoring and condition assessment, vehicle-bridge/road/track interaction analysis, advanced signal processing and smart sensor technology. Xinqu’s significant contribution is to condition assessment of civil infrastructure in operational environment. Currently, he works on integrated health monitoring for civil infrastructures in operational environment, providing a high level of consultancy in this area.

Grants/Projects
The use of innovative anchors for the achievement of composite action for rehabilitating existing and deployment in demountable steel structures (Uy, Zhu, Mirza), Australian Research Council Discovery Project, 2011-2013, $255,000.

Innovative substructure techniques for condition assessment of civil infrastructures (Zhu), University of Western Sydney, Research Grant Scheme, 2012-2013, $22,155.
### 7.5 HDR list with topics and Principal supervisor

<table>
<thead>
<tr>
<th>HDR Student</th>
<th>Supervisor</th>
<th>Project Topic</th>
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<tbody>
<tr>
<td>Mr Mohamed Ghannam</td>
<td>Professor Zhong Tao</td>
<td>Behaviour of Concrete-Filled Stainless Steel Columns under Fire Conditions</td>
</tr>
<tr>
<td>Mr Kamrul Hassan</td>
<td>Professor Zhong Tao</td>
<td>Behaviour of Hybrid Stainless-Carbon Steel Composite Beam-Column Joints</td>
</tr>
<tr>
<td>Mr Brendan Kirkland</td>
<td>Professor Zhong Tao</td>
<td>The Behaviour and Design of Composite Columns Coupling the Benefits of High</td>
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<td>Strength Steel and High Strength Concrete for Large Scale Infrastructure</td>
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<tr>
<td>Mr Steven Lamb</td>
<td>Professor Kenny Kwok</td>
<td>Psychological Response of Occupants in Wind-Excited Tall Buildings</td>
</tr>
<tr>
<td>Mr Mahdi Moosa Zadeh</td>
<td>Assoc Professor Sergiy Kharkivskiy</td>
<td>Novel Ultra Wideband Antennas for Microwave Imaging Applications</td>
</tr>
<tr>
<td>Mr Ali Razzazzadeh</td>
<td>Professor Zhong Tao</td>
<td>Hybrid Stainless-Carbon Steel Composite Beam-Column Joints at Elevated</td>
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<td>Temperatures</td>
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<tr>
<td>Mr Kwok-Shing Wong</td>
<td>Professor Kenny Kwok</td>
<td>Effects of Wind-Induced Tall Building Vibrations on Occupant Physical Task and</td>
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<td>Cognitive Performances</td>
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<tr>
<td>Mr Mohammad Yousuf</td>
<td>Professor Zhong Tao</td>
<td>Utilising High Performance Steels (HPS) for Critical Infrastructure Protection</td>
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<td>Against Extreme Loads.</td>
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<tr>
<td>Mr Xin Yu</td>
<td>Professor Zhong Tao</td>
<td>The Behaviour of Concrete-Filled Steel Tubular Columns Using Different Aggregates</td>
</tr>
</tbody>
</table>
7.6 Publications 2013

Book Chapter


Journal


Aslani, F. and Samali, B., 2013, Constitutive Relationships for Self-Compacting Concrete at Elevated Temperatures, Materials and Structures, published online.

Aslani, F. and Samali, B., 2013, High Strength Polypropylene Fibre Reinforcement Concrete at High Temperature, Fire Technology, published online, Vol.49, No.2.


Nabavi, F., Nejadi, S. and Samali, B. 2013, 'Investigation on the Mathematical Models of Chloride Diffusion Coefficient in Concrete, Journal of Civil Engineering and Architecture'.


Conference


Hassan, K., Tao, Z. and Uy, B. 2013, Effects of binding bars on the integrity of plate connections to concrete-filled steel tubular columns, Pacific Structural Steel Conference, pp 297-302.


Hou, S., Han, L. and Song, T. 2013, Finite element analysis on concrete-encased CFST columns subjected to heating and cooling fire, World Congress on Advances in Structural Engineering and Mechanics, pp 3858-3869.


Kharkovsky, S. 2013, Microwave sensor technologies for structural health monitoring of infrastructure, Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures.


Nabavi, F., Nejadi, S. and Samali, B. 2013, Investigation on Durability of Fibre Reinforced Concrete Exposed to Marine Environment, Proceedings of the 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures, RILEM.


Nabavi, F., Nejadi, S. and Samali, B. 2013, Durability of Polypropylene Fibre Reinforced Concrete Exposed to Marine Environment, Proceedings of the First International Conference on Concrete Sustainability.

Nabavi, F., Nejadi, S. and Samali, B. 2013, Experimental Investigation on Mix design and Mechanical Properties of Polymer Modified Concrete, Proceedings of the 14th International Congress on Polymer Modified Concrete.


Song, T., Han, L., and Tao, Z. 2013, ‘Behaviour of concrete-filled steel tubular column to restrained steel beam joints after exposed to full-range fire’, World Congress on Advances in Structural Engineering and Mechanics, pp 2120-2130.


Xu, W., Han, L. and Tao, Z. 2013, FEA modelling of curved concrete filled steel tubular (CCFST) trusses subjected to bending, World Congress on Advances in Structural Engineering and Mechanics, pp 2619-2629.


Yan, N., Dackermann, U., Li, J. and Samali, B. 2013, Numerical investigations of material property changes and stress wave behaviour in timber utility poles, Proceedings of the 6th International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-6), 9-11 December, The Hong Kong Polytechnic University, Hong Kong, (published on CD).


### 7.7 Seminar List

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Institution</th>
<th>Seminar Title</th>
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<tr>
<td>8 Mar</td>
<td>Dr Tian-Yi Song</td>
<td>Institute for Infrastructure Engineering</td>
<td>Performance of CFST Column to Steel Beam Joints Subjected to Heating and Cooling Fire</td>
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<tr>
<td>14 Mar</td>
<td>Dr Tian Sing Ng</td>
<td>University of NSW</td>
<td>Sustainability and Innovation in Geopolymer Concrete Construction: From Materials to Structures</td>
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<td>22 Mar</td>
<td>Dr Kwok Chung</td>
<td>Institute for Infrastructure Engineering</td>
<td>Performance Enhancement of Antenna Arrays for Wireless Structural Health Monitoring</td>
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<tr>
<td>11 Apr</td>
<td>Dr Olivia Mirza</td>
<td>School of Computing, Engineering &amp; Mathematics</td>
<td>Behaviour of the Headed Stud Shear Connectors on Composite Steel-Concrete Beams under Elevated Temperatures Utilising Carbon Nanotubes</td>
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<tr>
<td>26 April</td>
<td>Dr Won Hee Kang</td>
<td>Institute for Infrastructure Engineering</td>
<td>Reliability based capacity factor calibration of composite members</td>
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<tr>
<td>30 April</td>
<td>Dr Yuli Bludov</td>
<td>Centro de Fisica, Universidade do Minho, Portugal</td>
<td>Surface plasmon-polaritons in graphene: tunable excitation</td>
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<tr>
<td>3 May</td>
<td>A/Prof Sergiy Kharkivskiy</td>
<td>Institute for Infrastructure Engineering</td>
<td>An Embeddable Microwave Patch Antenna Module for Civil Engineering Applications</td>
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<tr>
<td>17 May</td>
<td>Prof Kenny Kwok</td>
<td>Institute for Infrastructure Engineering</td>
<td>Simulation of flow characteristics and wind load effects of transient strong wind events</td>
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<tr>
<td>31 May</td>
<td>Dr Hao Zhang</td>
<td>University of Sydney</td>
<td>System reliability considerations for steel design by inelastic analysis</td>
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<tr>
<td>28 June</td>
<td>Mr Kamrul Hassan</td>
<td>Institute for Infrastructure Engineering</td>
<td>Analysis and Design of Semi-Rigid Frames in a Composite Structure</td>
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<tr>
<td>12 July</td>
<td>Dr Kwok Chung</td>
<td>Institute for Infrastructure Engineering</td>
<td>A Study of Mutual Coupling Between Wideband Circularly Polarized Wang-Shaped Patch Antennas</td>
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<tr>
<td>26 July</td>
<td>Mr Ali Razazzadze</td>
<td>Institute for Infrastructure Engineering</td>
<td>Heat transfer analysis of hybrid stainless-carbon steel beam-column joints</td>
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<tr>
<td>2 Aug</td>
<td>Dr Jinhai Li</td>
<td>Kunming University of Science and Technology</td>
<td>Nonlinear vibrations of cables of Cable-stayed bridges and vibration control systems</td>
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<td>7 Aug</td>
<td>Dr Ken Tokeshi</td>
<td>Institute for Infrastructure Engineering</td>
<td>Synthetic Rayleigh Dispersion Curves of a Planar Surface layer and Inclined Baserock</td>
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<tr>
<td>7 Aug</td>
<td>Professor Gangbing Song</td>
<td>University of Houston</td>
<td>Recent Advances in Smart Aggregate Research</td>
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<tr>
<td>13 Aug</td>
<td>A/Prof Yan Yu</td>
<td>Dalian University of Technology</td>
<td>Design, Calibration and Some Applications of Wireless Sensors and Their Networks for Structural Health Monitoring of Civil Infrastructures</td>
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<td>23 Aug</td>
<td>A/Prof Sergiy Kharkivskiy</td>
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<td>Microwave sensor technologies for structural health monitoring of infrastructure</td>
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<td>13 Sep</td>
<td>Dr Chunwei Zhang</td>
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<td>Structural Swinging Motion Control</td>
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<td>20 Sep</td>
<td>Mr Mohamed Ghnam</td>
<td>Institute for Infrastructure Engineering</td>
<td>Fire Tests of Concrete Filled Stainless Steel Tubular Columns</td>
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<tr>
<td>4 Oct</td>
<td>Dr Yaping He</td>
<td>School of Computing, Engineering &amp; Mathematics</td>
<td>The use of lifts for emergency evacuation – a reliability study</td>
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<tr>
<td>8 Oct</td>
<td>Dr Y. X. (Sarah) Zhang</td>
<td>University of New South Wales</td>
<td>Mechanical and high velocity impact behaviour of a new hybrid fibre reinforced cementitious composite</td>
</tr>
<tr>
<td>18 Oct</td>
<td>A/Prof Zhong Tao</td>
<td>Institute for Infrastructure Engineering</td>
<td>Refined FE model for concrete-filled steel stub columns under axial compression</td>
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<tr>
<td>8 Nov</td>
<td>Dr Xinqun Zhu</td>
<td>School of Computing, Engineering &amp; Mathematics</td>
<td>Recent Advances on Moving Force Identification in Structural Dynamics</td>
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<tr>
<td>22 Nov</td>
<td>Dr Ee Loon</td>
<td>School of Computing, Engineering &amp; Mathematics</td>
<td>Multi-Span Composite Beams subjected to combined flexure and torsion</td>
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<tr>
<td>4 Dec</td>
<td>Prof Robert Meroney</td>
<td>Colorado State University, USA</td>
<td>(1) Fire Whirls, Fire Tornadoes and Firestorms: Physical and Numerical Modelling, (2) CFD Prediction of Dense Gas Clouds Spreading in a Mock Urban Environment</td>
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<td>6 Dec</td>
<td>Dr Fidelis Mashiri</td>
<td>School of Computing, Engineering &amp; Mathematics</td>
<td>Fatigue</td>
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</table>

This report prepared by Professor Kenny Kwok, Ms Magdalene Wong-Borgefjord, Ms Sumner Luo and Ms Pauline Shaw.