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WIND ENGINEERING SOCIETY Newsletter

Gwenaëlle Ambühl and Graham Knapp, Editors

Contents:

CONFERENCE SPECIAL

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WES NEWSLETTER
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❖ Chairman's Column

Professor Peter Bearman, Imperial College, London

Marco Vezza and Ian Taylor are to be congratulated on organising a very successful WES conference in Glasgow at the beginning of September. The technical content is reviewed elsewhere in this Newsletter and I would merely like to make a few personal comments. When Glasgow was first suggested as a possible venue for WES 06 there were questions raised as to whether it would attract a sufficient number of delegates. Any fears on this score proved unfounded and more than 50 people attended, with around 30% coming from overseas. In addition to paper presentations and posters, participants were treated to two excellent keynote lectures, one by Brian Lee and the other by Kenny Kwok. The international contingent brought an interesting perspective to the meeting and it resulted in the presentation of a number of thought provoking papers. The weather played its part in adding to the success of the conference, producing rain during the technical sessions and turning to warm sunshine the moment the conference ended. This was much to the delight of those overseas visitors who had arranged post-conference tours.

It is now time for the WES Executive Committee to start considering possible venues for the 8th UK Conference on Wind Engineering which is due to be held in 2008. I would be very pleased to hear from anybody with an interest in organising this event which is one of the most important items on the UK wind engineering calendar.

We are entering what is traditionally the time when we can expect high winds and a healthy rainfall. How appropriate then that the next meeting of WES is to be devoted to weather tightness. This will be an evening meeting at ICE, to be held on Wednesday 8th November, and is being organised by Gordon Breeze of the Building Research Establishment. I hope to see as many of you as possible there to hear the latest thinking on this important subject.

❖ Wind Engineering Society Conference Summary:

Summaries of some of the conference sessions have been kindly provided by the session chairmen.

Conference Overview

Marco Vezza

When it comes to assessing the success of a conference, consideration is given to, amongst other factors, the quality and breadth of papers, level of national and international participation, standard of conference facilities and, not least, the conviviality of the social gatherings after the daily sessions. It is my feeling, and that of my co-organiser Ian Taylor, both from our own perspective and through feedback from delegates, that the 7th UKWEC was a success on the above counts and, furthermore, demonstrated the continuing place for a vibrant, national conference in wind engineering in the UK.

The technical content of the conference provided a good balance between presentations on developments in CFD and other modelling techniques applied to wind engineering problems on the one hand, and experimental and full scale studies on the other. Building dynamics, aeroelastic effects, the wind environment and bluff body aerodynamics all featured in a well-balanced programme. The organisers were particulary happy to welcome Professors Kenny Kwok and Brian Lee to give the keynote presentations, but thanks are also due to all those who helped in the organisation of the conference: the UK Wind Engineering Society, abstract reviewers and staff at the Universities of Glasgow and Strathclyde.

Keynote 1

The first keynote presentation was given by Prof. Kenny Kwok (Kwok, Burton & Hitchcock) of HKUST on the subject of human perception of building motions due to wind. Prof. Kwok presented the issue of occupant comfort in buildings which experience wind-induced motion, in particular the effect of motion frequency and resulting motion perception, an aspect which has been neglected by many designers. Experimental tests on human subjects showed that, indeed, motion perception is frequency dependent.

Tall Buildings

Chairman – Marco Vezza

Full scale monitoring of the wind-induced response of a tall building was presented by Alan Moore (Moore & Wood) of the Univ. of Sydney. Details were presented of the instrumentation system comprising DGPS and accelerometers to measure building displacements and accelerations. Problems with the local wind assessment were addressed using a combination of wind tunnel model studies and data from an alternative reference. Effects of turbulence intensity on the first modes of vibration indicated a sensitivity in the bending mode but not the torsional mode.
The implications for occupant comfort criteria were discussed further by Melissa Burton (Arup) in a presentation related to the keynote (Burton, Kwok & Hitchcock). It was concluded that an important factor to consider when defining acceptability criteria is the duration of the motion stimulus.
The synthesis of experimental data and theoretical modelling for the prediction of tall building vibrations was presented by Ilaria Venanzi (Univ. of Perugia). Experimental pressure time histories were employed in a database assisted design scheme (DAD). Implications for the use of international codes of practice for torsional response of tall buildings were presented: in particular was concluded that, in some cases, the codes significantly overestimate the torsional response.
The final paper of the session, on experimental modelling of the vortex-induced response of a tall tower was presented by Ender Oskan of Arup (Oskan, Allsop, Sowdon & Buttgereit). The structure was highly non-standard, comprising a porous cladding with a cone and coronet feature at the top. The high frequency force balance technique was employed, and the sensitivity of the cladding to Reynolds number effects was investigated independently using a purpose built calibration rig. Static loads were obtained from model tests on the tower components , and further tests identified a susceptibility to vortex-induced vibration, towards the mitigation of which a tuned mass damper was specified.

Aeroelastic Phenomena

Chairman – John Macdonald

This was an interesting session mainly addressing vortex shedding and lock-in, along with methods of mitigation of wind-induced vibrations.

The session was opened by John Owen of Nottingham University describing different mitigation systems for vortex-induced vibrations of bridge decks. Wind tunnel tests had been conducted on a simplified ‘inverted U’ cross-section based on the Kessock Bridge, for the basic cross-section, with two different arrangements of baffles and with tuned mass dampers fitted. It was demonstrated that each system could be effective in reducing vibrations of the heave mode that was targeted, but undesirable increases of pitching mode vibrations could sometimes occur. The results of preliminary work on active mass dampers was then presented, for which simulations had shown potential reductions in amplitudes of both modes. It will be interesting to see if the potential benefits of such a system can be realised in practice as this work progresses.

Chris Letchford of Texas Tech. then gave the first of his three presentations at the conference, on vibrations of cantilever traffic signal structures. Such is the scale of things in Texas that cantilevers of up to 20m are needed to span only half way across the streets of Lubbock. Unsurprisingly these very slender cantilever structures are susceptible to vibrations and hence potential fatigue failure. However, contrary to the accepted wisdom, and the US national design guidelines, a combination of full scale and wind tunnel tests demonstrated that vortex shedding is a significant excitation mechanism. It can cause large amplitude vertical (across-wind) vibrations in fairly light winds, but interestingly only for winds from behind the traffic signals. Various mitigation measures were suggested by the conference audience, but it is yet to be seen which, if any, will be implemented.

Andy Robertson of the University of Strathclyde presented results of a validation exercise of a 2D discrete vortex method CFD code, based on the classical case of flow around an oscillating circular cylinder. Lock-in of vortex shedding and the magnitudes of static and dynamic force coefficients were predicted in good agreement with experimental data from the literature. As well as cross-stream oscillations, stream-wise and even rotational oscillations were considered, with good agreement in each case. This shows how far appropriate use of CFD has now come for such unsteady, highly separated flows. The discrete vortex method clearly has a future in wind engineering, and validation exercises such as this one are important for gaining confidence in its capabilities for future applications.

John Owen returned to describe a CFD study of the simplified Kessock Bridge cross-section, for which the emphasis was on understanding the mechanisms of vortex excitation. A 2D model of the coupled fluid-structure system was adopted, which exhibited lock-in and predicted amplitudes of vibration in good agreement with the sectional model wind tunnel tests. Detailed consideration of the pressure distributions over the surface of the bridge deck showed that during lock-in the pressures on the upper face were significantly modified in phase and distribution, which could be related to transitions to or from lock-in.

The session was concluded by Anna Bagnara of BMT fluid Mechanics, who presented a case study of galloping of a trapezoidal bridge mast of a cable-stayed pedestrian bridge. An impressive video of the full aeroelastic model showed the severity of the problem for the original mast cross-section. A wide range of aerodynamic mitigation measures were tested, including triangular additions, porous fins, turning vanes and plates separated from the main cross-section. The porous fins were the most effective, but for aesthetic reasons a separated plate was chosen, which was also very effective, although the behaviour was sensitive to the size of the gap.

Overall, the session showed the value of the different methods of wind tunnel tests, CFD and full-scale tests in identifying excitation mechanisms and designing various vibration mitigation measures.

2nd Keynote and Cable Dynamics.

Chairman – Ian Taylor

Professor Brian Lee opened this session with the second keynote lecture of the conference, posing the question “Is Climate Change Making Tropical Cyclone Damage Worse?” The presentation reviewed the currently available data, and discussed the evidence from the viewpoint of both the proponents and the opponents that climate change is causing stronger tropical storms. Prof. Lee used Hurricane Fran to illustrate the nature of a typical storm, though he did make clear that this violent swirling mass of hot air had no similarity whatsoever to his wife … Fran.
Whilst reviewing the discussion presented by the proponents, it was highlighted that although there was some evidence that climate change was having an effect, it was clear that there was some questionable use of data. This is the main argument of the opponents to the link between stronger storms and climate change. In particular, that as yet “an insufficient time period has been used in the analyses”. Also, Professor Lee highlighted that El Nino effects may account for a significant part of the effects that have been put forward by the proponents. In summary it is felt that “current knowledge and available techniques are not able to provide robust quantitative indications of potential changes” and that at present, climate change is NOT making tropical cyclone damage worse.

Following on from the keynote talk, three papers were presented, all on the topic of cable dynamics. First Symes presented a development of the quasi-steady model to illustrate the significant effect of turbulence on cable galloping. In particular that neglecting the effect of turbulence in the quasi-steady analysis leads to an overestimation of the minimum structural damping required to prevent galloping. Yagi presented an interesting paper on how the Karman vortex has a strong effect on the fluid-structure interaction mechanism of inclined cables, both in rain-wind and dry cable oscillations. Using wind tunnel results, he illustrated the various phenomena, from VIV, critical Reynolds number effects, and galloping instabilities that can be explained as a similar aerodynamics phenomenon of circular cylinder with a splitter plate in the wake. Finally in this session, MacDonald demonstrated how recent developments in quasi-steady analysis of cable galloping have been used to understand the mechanism of conductor oscillations in the 1960’s. The theoretical analysis demonstrated that even in the absence of ice or rain, skew winds could lead to cable oscillations large enough to cause flashover, agreeing with field investigations in the 1960’s.

Wind Environment

Chairman – Ian Castro

This session contained six papers, four of which addressed specific and somewhat disparate aspects of wind environment. Graham Wood (Sydney) presented and discussed results of some laboratory experiments on tilted axi-symmetric jets impinging on a ground plane, modelling downburst events. Reasonable agreement with corresponding simulations obtained using a modern turbulence model was found. The presence of escarpments on the ground plane obviously yielded modified behaviour and an interesting conclusion was that velocity speed-up factors were rather lower than those which occur in regular boundary layer flow over topography. A second paper on topographic effects was presented by Chris Letchford, who used new wind tunnel data to assess a number of current national building codes in terms of their recommendations for topographic multipliers on 3-second gusts. It was interesting (for this listener at least) to hear that some codes do and some do not take any account of surface roughness effects and that the functions supplied for speed-up decay (with both height and axial fetch) are not only different between codes, but even yield opposite effects. It seems rather unlikely that a ridge in the USA affects a given upstream boundary layer differently to one in Australia or in Europe, so the code writers clearly have some intercontinental cooperation challenges!

The other two environment papers addressed issues of extreme winds. Mark Sterling discussed wind statistics obtained from measurements at Silsoe, showing the likely influence of 'sweeps' and 'bursts' (to use ordinary turbulent boundary layer terminology) on instantaneous velocity profile shapes. He argued that incorporation of these unsteady characteristics of the approach flow might need to be considered for inclusion in design criteria for wind loading in response to gusts. Penny Boorman (Hadley Centre) discussed various ways of estimating how extreme wind intensities and frequencies might change as a result of climate change, using Met Office climate and forecasting models. She showed that although geostrophic winds can be used, more physical information is supplied by using peak gust parameterisations - these avoid sampling issues. She wisely refused to be drawn on whether it was likely that we'd see more and/or stronger wind gusts in the future!

The other two papers, sandwiched between these first four, were quite different. Nick Cook (RWDI Anemos Ltd.) described the new RWDI Anemos boundary layer wind tunnel and presented some typical mean velocity and turbulence profiles obtained within the open jet working section. An innovative feature of the tunnel is the contracting corner vanes, turning the flows from the two fans through 180^{o} to meet and enter the boundary layer development section. Some force measurements on a model previously tested elsewhere confirmed the very satisfactory behaviour of the new tunnel and its associated instrumentation systems. It was nice to see a tunnel being built, rather than scrapped.

Finally, Chris Baker (Birmingham) encouraged us all by pointing out that the Civil Contingencies Act (2004) not only provides impetus for radical re-organisation of emergency planning procedures, but has thereby provided a much more obvious opening for Wind Engineers to offer their expertise. The 'Category 1' organisations (like Local Authorities, Fire & Ambulance Authorities and NHS Bodies) are now mandated to be much more pro-active in developing preparedness planning, etc., so there is some hope that our community might at last be seen by such authorities to be useful!

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❖ Future WES Events

at the Institution of Civil Engineers, One Great George Street London SW1P 3AA
Wednesday 8th November 2006 at 6.00pm

Weather-Tightness

Weather-tightness of layered building envelopes
Stephen Ledbetter, Director of Centre for Window and Cladding Technology

Climatic influences on the design of pitched roofs
Dr Nigel Cherry, Lafarge Roofing Technical Centre

Weather-tightness of metal clad roofs
Keith Roberts, Principal of Roberts Consulting

Methods of testing the weather resistance of building facades
Chris Macey, MD of Wintech Group

Chairman: Gordon Breeze, Building Research Establishment
Please note there is no charge and non-members of the Society are welcome to attend

See separate flyer for further information

❖ Announcements

Lecturer/Senior Lecturer in Civil Engineering Fluid Mechanics (Ref: 5582)

Salary: £27,989 - £42,573 per annum (subject to experience and qualifications)

Applications are invited for a Lectureship/Senior Lectureship in Civil Engineering within the School of Engineering. The candidate should have experience in fluid mechanics and must have strong research interests in wind engineering. In addition, the candidate should have a higher degree, as well as relevant publications and professional experience. A record in gaining research funding would be particularly welcome.

Informal enquiries may be made to Professor Gerard Parke, Head of Civil Engineering, (Tel: +44 (0)1483 689544, Fax: +44 (0)1483 450984, email: G.Parke@surrey.ac.uk), or Professor Alan Robins, Head of the Fluids Research Centre. (Tel: +44 (0)1483 689684, Fax: +44 (0)1483 689645, email: A.Robins@surrey.ac.uk).

To apply, please visit our website www.surrey.ac.uk or contact Hilary Mitchell on 01483 686283 or engineering.vacancies@surrey.ac.uk. Please state reference 5582, your postal address and where you saw this advert

Closing date for applications 10th November 2006
Interview board will be held on 14th December 2006

Visit the School of Engineering website at http://www.surrey.ac.uk/eng/

Research Fellowship

Dr John Macdonald of the University of Bristol has recently been awarded an EPSRC Advanced Research Fellowship on wind-induced vibrations of slender structures. The Fellowship will release him from teaching and administration duties for the next 5 years, to enable him to concentrate on research. The proposed work will build on his recent work on dry inclined cable galloping, considering the various effects of wind turbulence, cable surface finishes, hysteresis of flow transitions and unsteady aerodynamics. The aim is to generalise the analysis as far as possible, with potential application to structures such as guyed masts, electricity transmission lines, chimneys, lamp columns, and possibly marine structures, as well as cable-stayed bridges. Static and dynamic wind tunnel tests will be performed on inclined/skewed cylinders of different arrangements, concentrating on the aerodynamic forces in the critical Reynolds number range, to inform and provide data for the analysis. Later, large scale dynamic wind tunnel tests will be undertaken in collaboration with the National Research Council in Ottawa, to hopefully validate the analysis.
In parallel with this work on the aeroelastic loading mechanism, Dr Macdonald will continue his work on non-linear structural dynamic interactions, such as cable-deck interaction on cable-stayed bridges, including the 'parametric excitation' mechanism. A key part of the Fellowship is to bring together the work on aerodynamic and structural dynamic aspects, to consider the overall dynamic response of slender structures to wind loading, including combinations of loading mechanisms on different components (e.g. cables and bridge decks) as well as interactions between them. Dr Macdonald also plans to develop other research on damping systems and other dynamic interactions, such as pedestrian-structure interaction. He is keen for his research to be of practical relevance, so he would welcome further contacts with industry (email: John.Macdonald@bristol.ac.uk).

Announcement of Principals of RWDI Group Inc

Peter Irwin, from RWDI press release

I am pleased to announce that in recognition of their outstanding achievements and consistent performance, Paul Freathy, Stoyan Stoyanoff and Jiming Xie have been made Principals of RWDI Group Inc., effective August 1, 2006. Paul was already a shareholder of RWDI Anemos Ltd. where he has been Managing Director since it was formed in September 2004. With this appointment, he will exchange his ownership in RWDI Anemos for corresponding ownership in RWDI Group Inc. Paul ran his own successful wind consulting firm, PF Consultants, for a number of years and then formed Anemos Associates Ltd. (Anemos) with Nicholas Cook. Anemos developed an excellent reputation and worked with many well known U.K. clients. Two years later, Paul and Nicholas became members of the RWDI team when Anemos and RWDI joined forces to form RWDI Anemos Ltd.

Stoyan joined RWDI in 1993 as a Senior Specialist. Following that, he became a Project Director and Associate. His project involvement with the company has focussed on the field of aerodynamics, aeroelasticity, structural dynamic, finite elements, and wind effects on various types of engineering structures (bridges, stadiums, buildings, towers, transmission lines, space vehicles). As Project Director, he coordinates and supervises aerodynamic and structural dynamic studies. In addition, Stoyan has been a leader in developing advanced analytical methods for the wind response of long span bridges.

Jiming joined RWDI in 1989 as a Project Engineer and was subsequently appointed Project Director and Associate. His primary responsibility is conducting wind engineering studies for large structures, including bridges, buildings, stadiums, etc. as well as being responsible for quality assurance and technical development of the company's wind engineering services. Jiming has been responsible for the development of several cutting edge methods for determining design wind loads and responses of complex high-rise structures.

On behalf of the management of RWDI, I would like to take this opportunity to personally congratulate Paul, Stoyan and Jiming and welcome them as shareholders of RWDI Group Inc.
Congratulations!

❖ Forthcoming Conferences

2007

12th International Conference on Wind Engineering (ICWE12)

Cairns, Queensland, Australia, 1 – 6 July

www.awes.org/icwe12