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WIND ENGINEERING SOCIETY Newsletter

Gwenaëlle Ambühl and Graham Knapp, Editors

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WES NEWSLETTER

Volume 9, No. 2: April 2007

❖ Chairman's Column

Professor Peter Bearman, Imperial College, London

Two years have passed extremely quickly and this is my last Chairman's Column. At the May Annual General Meeting I will be passing the WES baton into the extremely capable hands of David Mackenzie. Looking back over those two years the most significant development for wind engineering must surely be the recognition of climate change as a major global issue. The terrible devastation caused by Hurricane Katrina highlighted once again the damaging effects of major storms and, regardless of whether we think the connection is proven, climate change is being linked with a more frequent occurrence of high winds. In turn this will place a higher priority on maintaining expertise in wind engineering. On a relatively more parochial level, it should not go without comment that over the past two years WES members have had the opportunity to attend a series of extremely interesting evening meetings. In 2005 we were treated to an excellent Scruton Lecture by Peter Irwin and in 2006 the UK Wind Engineering Conference was very successfully hosted in Glasgow by Marco Vezza and Ian Taylor. I would like to extend my thanks to all those who have helped to make our events interesting, worthwhile and successful.

I have been impressed by the way people have so willingly given their time to support WES. Thanks are due to the WES Committee members, to Gwenaëlle Ambühl and Graham Knapp for revitalising the Newsletter and to Mark Sterling for maintaining the WES web site. In addition, it would be extremely difficult for WES to function without the excellent secretarial support provided by ICE, first from Maya Shcherbakova and more recently by Lotte Grant.

Looking back over the development of WES one of its most significant achievements was the publishing of "A Strategy for Wind Engineering Research" in the late 1990s. This can now be viewed in full on the WES web site (www.ukwes.bham.ac.uk). A short update has been added to highlight those areas which remain of great significance and require further research. The strategy emphasises the importance of two major tools used in wind engineering, wind tunnel testing and CFD and we have decided to devote two evening meetings to these topics. Following the AGM on Wednesday 16th May, there will be presentations on developments in CFD applied to wind engineering and early next year we have a similar meeting planned on wind tunnel technology.

In almost every area there is good progress to report but WES continues to struggle to maintain its membership numbers. Members bring subscriptions, and subscriptions provide the funds to run the Society and to put on events. The WES business plan requires us to increase our numbers, both individual and corporate members. Fees remain extremely modest and I call upon all members to encourage colleagues in the wind engineering field to join WES.

WES NEWSLETTER

Volume 9, No. 2: April 2007

❖ Research News

Wind Engineering Research Strategy

In 1997 the Wind Engineering Society published "A Strategy for Wind Engineering Research". This document was produced by the WES Research Committee under the guidance of its Chairman Professor Brian Lee. In 2006 WES decided that it was time to revisit the research strategy and possibly to publish an updated version. Gordon Breeze and Nigel Wright took on the task of reviewing the strategy and came to the conclusion that much of the strategy remained as relevant today as it was when it was produced in 1997. That is not to say that nothing has changed. For example, the current concerns about climate change bringing more extreme weather conditions places a greater urgency on having a thorough understanding of wind engineering issues. On the technology front it is clear that computational methods have advanced considerably in the past 10 years. In addition to the need to develop and exploit these methods further, we are at a stage where more informed guidance is needed on when computation can safely replace other analysis techniques.

The Breeze/Wright report was considered in detail by an enlarged group including Brian Smith, Mike Graham and Peter Bearman. The findings of this group are summarised below under a number of headings. It is recommended that this updated view is read in conjunction with the original 1997 wind engineering research strategy. Hence we have brought these documents together on the WES web site (www.ukwes.bham.ac.uk).

WES does not have funds to advance the research described in the strategy but it is hoped that the document will act as a guide to future research requirements. Also it may be brought to the attention of research funding agencies when submitting bids in the wind engineering area.

WES NEWSLETTER

Volume 9, No. 2: April 2007

Addendum to "A Strategy for Wind Engineering Research"

What is Wind Engineering?

Wind Engineering is a multi-disciplinary subject concerned with the effects of wind on the natural and built environments. It brings together engineers, architects and meteorologists to help protect against the destructive effects of wind and to harness its beneficial aspects.

Why is Wind Engineering Important?

The effects of wind have a significant impact on life on this planet:

- Buildings and structures must be designed to withstand the force of wind.
- Wind is responsible for the dispersion of pollutants.
- Wind is a source of renewable energy.
- Heat transfer from buildings and people is increased by wind.
- Ventilation and the spread of fire are influenced by wind.
- Severe winds disrupt road and rail transport.
- Wind conveys particulate matter leading to soil erosion, sand storms and snow drifting.
- Wind generates ocean waves which may endanger shipping and destroy coastal defences.

What are the Main Topic areas Covered by Wind Engineering?

- The structure of the atmospheric boundary layer.
- The probability of wind occurrence and risk analysis.
- The classification of storms and assessment of damage caused by severe winds.
- Wind loads on buildings and structures.
- Cladding loads and weather tightness.
- Improved assessment of wind effects leading to more reliable design codes.
- Influence of wind on building ventilation systems, heat transfer, the spread of fire and flow-induced noise levels.
- The response of wind-sensitive buildings and structures such as tall towers and long span bridges.
- Influence of wind on transportation systems.
- The effect of wind on dispersion and deposition of pollutants.
- Human response to wind, including stability in wind and wind chill.

Approaches Used in Wind Engineering

- Instrumentation employed to measure peak winds and wind structure.
- Full scale measurements on instrumented buildings and structures.
- Wind tunnel studies, often involving simulation of the atmospheric boundary layer and frequently to address problems not adequately covered by codes.
- Numerical modelling including the use of CFD and, where there is fluid/structure interaction, the coupling of fluid and structural codes.

The Importance of Wind Engineering to the UK

- Compared to many other countries the UK is exposed to a relatively high average wind speed.
- The occurrence of severe winds may be increasing, leading to costly damage, as illustrated perhaps by the recent destructive tornados in the UK.
- The UK has internationally leading architectural and consulting engineering practices which compete in a global market.

Areas of Growing Importance in Wind Engineering

- Understanding the likely impact of climate change on the occurrence of high winds.
- Protecting people in the developing world from the effects of extreme winds.
- Assessing the effects of wind on mega structures, both very long span bridges and tall towers that reach through the atmospheric boundary layer.
- Predicting the response due to wind of lightweight structures, such as footbridges, constructed from unconventional materials.
- Predicting the influence of wind on pollutant dispersion in built up areas, possibly following terrorist action.
- Developing CFD as a reliable quantitative method for solving a wide range of wind engineering problems, in addition to its use as a qualitative tool.

WES NEWSLETTER

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❖ Research News

What price Reynolds number similarity? A cautionary tale.

Ian P Castro, University of Southampton.

For over three decades wind engineers engaged in laboratory modelling of full-scale situations have been cheered by the belief that for flows over sharp-edged obstacles like (most) buildings, provided the appropriate model Reynolds number (Re) significantly exceeds 10^4, the flow will not differ significantly from that at full-scale. This would imply that, for example, mean surface pressure coefficients would be very similar. This, indeed, provides much of the motivation for model work and the consequent continuing use of wind tunnels for wind loading studies.

There are conceptual reasons why this longstanding Re-independency assumption may not (or even cannot) be universally applicable. At the international Wind Engineering conference in Copenhagen in 1999, Alan Davenport (no less!) publicly questioned the assumption and there has also since been some evidence of its shortcomings in some of the full-scale experiments on Silsoe buildings, by Roger Hoxey and his associates. Spring last year saw the completion of a new study of this issue, funded by EPSRC and carried out at the University of Southampton, in collaboration with Silsoe. Some of the major results have recently been published in a JFM paper (see below). Readers with sufficient curiosity may wish to look at the details in the paper, but the following paragraph summarises our major findings.

Data were obtained for flow over a cube mounted in a thick turbulent boundary layer, in two wind tunnels and covering a Reynolds number range in excess of 20. The same upstream turbulence conditions were present throughout. New experiments on the 'Silsoe cube' provided a further order-of-magnitude increase in Re, with very similar upstream conditions. We found that if the flow did not contain strong concentrated-vortex motions (like the delta-wing type vortices present over the roof for buildings oriented at, say, 45° to the oncoming flow), Re effects only appear on fluctuating quantities – like r.m.s. surface pressures. On the other hand, for flows characterised by the presence of such vortex motions, Re effects are significant even on mean-flow quantities like mean surface pressure coefficients. So whilst in certain circumstances and for some quantities the Re-independency assumption may be valid, there are other important quantities and circumstances for which it is clearly not. There is little reason to suppose that these conclusions would not apply to other sharp-edged, cuboid shapes.

The lesson, perhaps, is that Wind Engineers engaged in modelling studies need to be even more cautious than they (of course) always are in designing and interpreting model experiments intended to act as surrogates for much higher Reynolds number full-scale situations. That's progress for you!

Ref: Lim HC, Castro IP & Hoxey RP (2007) Bluff bodies in deep turbulent boundary layers: Reynolds-number issues. J. Fluid Mech. 571, 97-118.

Comments on this paper are invited from WES members offering wind tunnel testing services - ed

❖ Books

Designers' Guide to EN 1991-1-4 Eurocode 1: Actions on structures, general actions part 1-4. Wind actions

N. Cook

Price: £ 50.00

EN1991-1-4, Eurocode 1: Actions on structures -General actions - Part 1-4: Wind actions, is the head code for wind actions on structures and describes the principles and requirements for calculating design wind loads on structures. It complies with the requirements of Eurocode EN1990, Eurocode: Basis of Structural Design, and provides the wind actions necessary to implement the structural design Eurocodes 2 to 9.

The principal aim of this book is to provide the user with a commentary on the interpretation and use of EN1991, Eurocode 1: Actions on structures - General actions - Part 1-4: Wind actions, and on the expected changes that will be introduced by the associated National Annexes. In particular, the opportunity has been taken to add a commentary on the changes introduced in the UK National Annex.

Designers may find the highlighted ‘important warnings’ particularly useful, concerning key changes from current UK practice

Contents

- Design situations
- Modelling of wind actions
- Wind velocity and velocity pressure
- Wind actions
- Structural factor CsCd
- Pressure and force coefficients
- Wind actions on bridges
- Annexes
- Preface
- Postscript
- References

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WES NEWSLETTER

Volume 9, No. 2: April 2007

❖ Forthcoming Conferences

2007

12th International Conference on Wind Engineering (ICWE12)

Cairns, Queensland, Australia, 1-6 July 2007

www.awes.org/icwe12

Sixth International Colloquium on Bluff Body Aerodynamics & Applications

Milan, Italy, July 20-24, 2008

http://bbaa6.mecc.polimi.it/

VI World Wind Energy Conference and Exhibition, WWEC 2007, Mar del Plata, Argentina

September 29-October 4, 2007

http://www.wwec2007.org.ar/

❖ News

Storm Damage

The latest report from CROSS contains information on structural damage during the recent storms. The report is available free of charge at http://www.scoss.org.uk/cross/newsletters.asp. Members are encouraged to report any structural failures they become aware of through this important confidential reporting scheme.

WES NEWSLETTER

Volume 9, No. 2: April 2007

❖ Announcements

Apologies from the editor – this announcement should have appeared in the last issue:

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).

Dr. Leighton Cochran promoted to CPP Principal

From CPP press release

Dr. Leighton Cochran has been promoted to CPP Principal.

Leighton joined CPP in 1993 and, since then, has dedicated himself to excellent client service, high technical quality standards, and to the promotion of the field of wind engineering around the world. He has published technical papers and industry journal articles and, recently, has spoken at conferences in India and Argentina. Leighton is also the president of the American Association for Wind Engineering (AAWE) for the 2007-2008 term.

In recognition of his many years of remarkable service and leadership, CPP is proud to name Leighton a CPP Principal. Thank you, Leighton, and congratulations!

WES NEWSLETTER

Volume 9, No. 2: April 2007

From Halcrow press release:

Spinnaker Tower receives mention at 2007 Civic Trust Awards

The Portsmouth Spinnaker Tower has received a mention in the Civic Trust Awards for 2007.

Halcrow Yolles was services engineers for this spectacular landmark and viewing tower. Prominent from both harbour and sea, the tower's symbolic shape is fast becoming an icon for Portsmouth.

The Civic Trust Awards recognise the best in the built environment, from architecture to planning, townscape to housing. They recognise the public realm and a belief that development should be for the people.

From RWDI Anemos press release:

RWDI Anemos Expanding Again!

Continuing their growth strategy, RWDI Anemos has recently taken on the lease of additional premises in Dunstable, UK to expand their office and workshop facilities. Since Anemos joined with RWDI in 2004 the company has increased staff numbers five-fold and sales turnover by a similar factor. Managing Director, Paul Freathy, comments "We have just completed three years of rapid growth, expanding the breadth and depth of the projects handled in the UK to include many major international developments. The acquisition of Unit 5 is the next step in our growth strategy that will enable us to better meet client needs and timelines."

The new Unit will house additional engineering and technical staff plus expanded workshop facilities for model-building. This expansion fits with the imminent start-up of RWDI's Florida wind tunnel, which is expected to start project work in June 2007. The Florida opening will bring our resources to four wind tunnels, giving us an unrivalled ability to share work and maximise the efficient production of design information. It further cements the Group's position as the largest wind engineering consultancy in the world.

WES NEWSLETTER

Volume 9, No. 2: April 2007

❖ Future WES Events

Godfrey Mitchell theatre

at the Institution of Civil Engineers, One Great George Street London SW1P 3AA

Wednesday 16th May 2007 at 7.00pm (approx.)

Application of CFD in Wind Engineering

Speakers

Professor Nigel Wright:	**Key issues and pitfalls in modelling flows in urban areas**
Professor Ian Castro:	**Large Eddy Simulation for Urban Meteorology – is it Viable?**
Ian Jones:	**Developments in CFD for the prediction of wind flows in an urban environment**

Chairman: Mike Graham, Imperial College

Please note there is no charge and non-members of the Society are welcome to attend – please pass details on to your colleagues

See separate flyer for further information

This event will be preceded by the WES AGM at 6.30pm

Wednesday 14 November 2007

Scruton Lecture

Andrew Allsop, Arup Advanced Technology Group

Further details to follow