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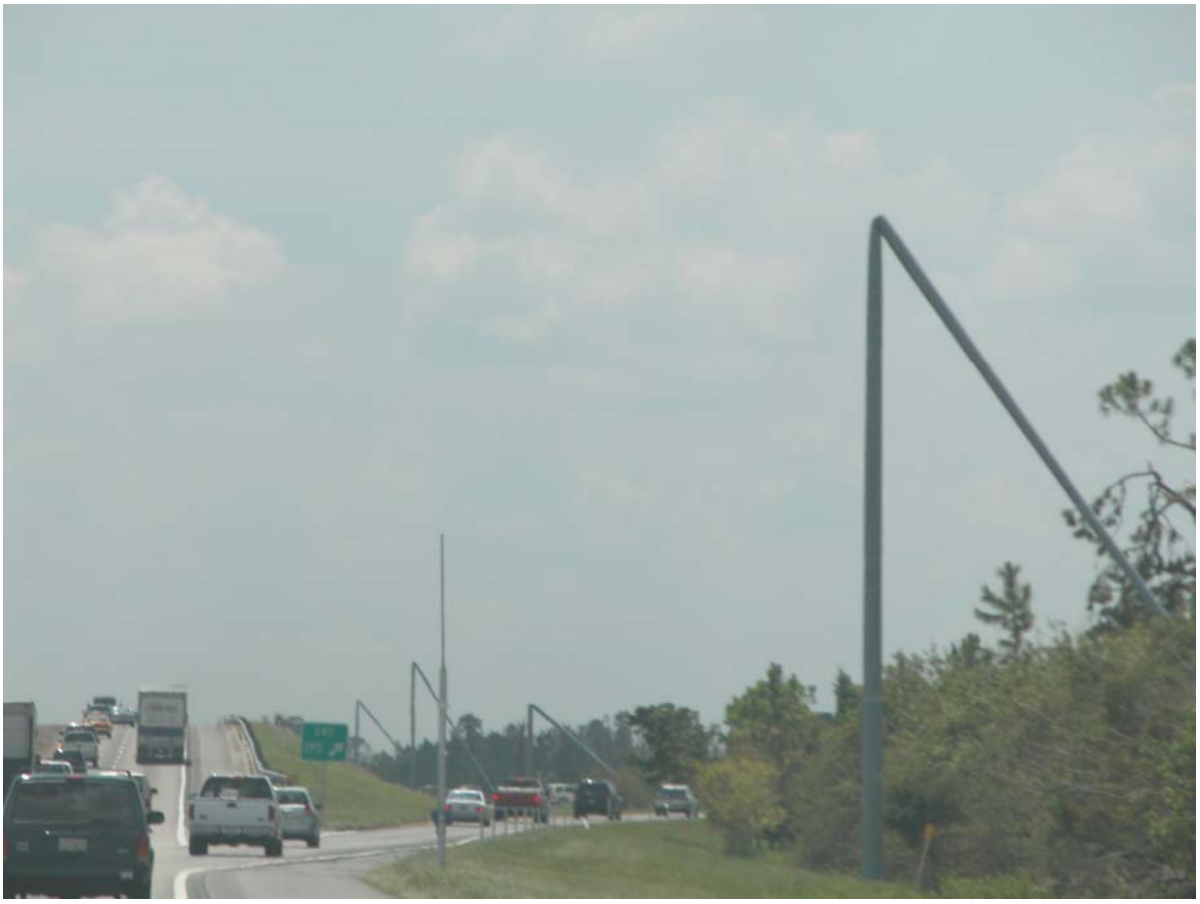
WIND ENGINEERING SOCIETY Newsletter



Lights out as Hurricane Charley visits Florida.

Photograph courtesy of John Holmes

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WES NEWSLETTER
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❖ Ramblings

Welcome to the fourth and last WES newsletter of 2004 and many thanks to those of you who have contributed. The newsletter contains the usual Snippets of wind related news stories from around the world which again have been complied by Ms Sarah Jordan who has also contributed significantly in other ways (see later). Various members have taken the time to report from particular sessions at the WES Conference and their contributions are greatly appreciated. I've taken the liberty of including details and abstracts of the next technical meeting which will examine the effects of high winds on trains. As always these details can be found on the website, but I am aware that a significant number of you do not necessarily check this on a regular basis.

Since this will be the last newsletter of the year, on behalf of all the WES committee may I take this opportunity of wishing you a "Merry Christmas". (Yes, I know it's too early to be doing this but some of us have already finished shopping!).

Mark Sterling

❖ Chairman's Column

Paul Freathy writes:

In September we saw the successful staging of the 6th UK Conference on Wind Engineering at Cranfield. With around 70 delegates and a full program of papers, this conference kept up the tradition of being both informative and informal. This is not always an easy balance to maintain but the Silsoe team who did all the organisation did an excellent job on our behalf. Rogers Hoxey was an accomplished meeting chairman, Andrew Quinn kept the technology running smoothly and Eileen Martindale made sure we had the information we needed, when we needed it. We had visitors from several countries who will have witnessed a strong Wind Engineering Society that is doing good work in this field.

Other achievements in the last few months include the new-look web site which has been updated to comply with the requirements of the Disability Discrimination laws. Mark Sterling has guided this process and I think the result is a great improvement. I urge you all to take a look at www.ukwes.org. I am sure Mark will welcome any suggestions as to how the site could be made even better as a service to both members and those who are browsing for information on wind engineering.

The WES committee has also formally applied for membership of the re-vamped IAWE (the International Association of Wind Engineering). This will make sure we stay as a strong member of the international community of wind engineers. We have also approved a contribution towards the funding of the Advisory Committee on Natural Disaster Reduction. This registered charity is chaired by Brian Lee, past chairman of this Society, and has wide-ranging aims to promote the better understanding of the causes of natural disasters, the means for disseminating information to those in vulnerable areas and the development of mitigation strategies. There is arguably no more important role for wind engineers and we wish that organisation every success in the future.

All in all we have had a active time recently but there is still more to do, with your help.

❖ Snippets

- **Engineers gather hurricane information.** The Florida Coastal Monitoring Program has been gathering information from this season's hurricanes. Researchers have fitted rooftop pressure sensors to a number of houses, and erected portable weather stations where hurricanes were coming ashore, and carried out damage surveys to see which houses withstood the storm. The program has found that houses constructed since Florida's last building code revision fared far better than even slightly older ones. (http://www.gwinnettdailyonline.com/GDP/archive/articleB16658B7BFE04176A7789D5C8A9D0EC9.asp)

- **NASA to demolish historic wind tunnel.** The sixty three year old 16-Foot Transonic Wind Tunnel at NASA Langley Research Center has been shut down, and is planned for demolition. During its lifetime it tested the design of a number of aircraft and spacecraft, including the moon mission spacecraft and the space shuttle. (http://www.dailypress.com/news/local/dp-

85355sy0sep25,0,4786236.story?coll=dp-news-local-final)

- **Farnborough saved.** A £20m scheme has been announced to restore and reuse the main 25 acres of the former Royal Aircraft Establishment at Farnborough in Hampshire, where Britain's first powered controlled aircraft was flown in 1908 by Samuel Cody. The 120m concrete wind tunnel with 9m diameter mahogany blades may be turned into a theatre. The original proposals for developing the site had involved flattening most of the buildings. (http://www.guardian.co.uk/uk_news/story/0,3604,1309812,00.html)

- **Aerodynamic crisis of volleyballs.** If a volleyball player refrains from hitting the ball as hard as possible but goes for a slower serve then the ball can swerve unexpectedly. Thomas Cairns, a mathematician at the University of Tulsa, explained why this occurs at the 5th International Conference on the Engineering of Sports. This behaviour is due to the drag crisis which occurs at a speed of about 15m/s. (http://sciencenow.sciencemag.org/cgi/content/full/2004/916/1)

- **Bats and wind turbines.** Research in the US has found that wind farms placed on ridgetops kill a large number of bats. For example, 2092 bats were killed last year by a group of turbines on Backbone Mountain, West Virginia. This year scientists used high-tech equipment to try to find the reasons why bats fly into the turbines. One hypothesis is that insects are attracted to these areas in certain wind conditions; there could also be sound factors. (http://www.enn.com/biz.html?id=26)

- **Combating almond dust cloud.** The Almond Board of California is financing research to find the right equipment and practices to reduce the amount of dust kicked up from harvesters. Nearly 41lbs of microscopic dust particles are raised when an acre of almonds is harvested. By comparison wheat raises 5.8lbs and cotton 3.4lbs per acre. There are new regulations in place to control this airborne health hazard. (http://www.heraldonline.com/24hour/business/story/1713215p-9520486c.htm)

- **Record distances travelled by GM grass pollen.** Grass seeds gathered from around experimental plots of GM Creeping Brentgrass revealed that wind pollination had resulted in gene contamination at 21km from the plots. The findings have come at a time when US regulators were deciding whether to permit the grass to be sold to golf courses. (http://www.newscientist.com/news/news.jsp?id=ns99996421)

- **US vehicle emission cuts.** In September, California air quality regulators set the first standards in the US to reduce the greenhouse gases emitted by road vehicles. The auto-industry has challenged the state's authority to do this, and is expected to challenge the standards in the courts. Other states are likely to follow California's lead. (http://www.reuters.co.uk/newsArticle.jhtml?type=scienceNews&storyID=6330742&src=rss/uk/scienceNews&section=news)

- **5000 year old hurricane record.** Hurricanes can drive the ocean over barrier islands (sandy reefs parallel to the shore) so pushing seaward side sand to the inshore side. Each deposit gets covered by soil and creates a record of hurricane activity. Jeff Donnelly, a geologist at the Woods Hole Oceanographic Institute in Massachusetts, is analysing cores of these deposits to see if hurricane activity has changed. In a few cases he has a record spanning 4 or 5 thousand years. (http://www.guardian.co.uk/life/news/story/0,12976,1307209,00.html)

- **Beijing choked due to air pollution.** Beijing was shrouded in a hazardous smog which reduced visibility to a few hundred metres during President Chirac's visit to the city. An aerobatic display had to be cancelled, people were advised to stay indoors, and highways were closed. The pollution had built up over several windless days.

(http://www.guardian.co.uk/international/story/0,3604,1324291,00.html)

- **Dust storm problems** in Greenland and is threatening human health. (http://www.guardian.co.uk/climatechange/story/0,12374,1287212,00.html)

(Ed – Thanks to Sarah Jordan for this section).

❖ Political fluctuations stall US Wind Hazard Bill

The following information is taken from ASCE news, August 2004, Vol. 29, No.8:

The National Impact Reduction acts was passed in the US House of Representatives by a large majority [387 to 26] on 8th July 2004 and was expected to sail through the appropriate Senate Committee, which was held two weeks later. The problem resolved around a number of amendments added to the bill and a little invoked "two hour" debated rule. The two hour rule prevents Senate committees from conducting business lasting more than two hours while the full Senate is in session. As a result of political wrangling with respect to a nomination to the Federal trade commission, a certain senator invoked the rule and halted the bill's progression.

(The Windstorm Impact Reduction Act would establish a multi-agency programme that would seek to decrease the losses of life and property caused by windstorms. The bill aims to encourage the government, universities and the private sector to work together on developing strategies to minimize the human and infrastructure costs associated with strong winds. The bill has a proposed budget of $20million for the next three years).

❖ Reports from the WES conference

Wednesday morning, Extreme Winds and the ABL– Mark Sterling

On the first day of the conference a joint session held with the Royal Meteorological Society examined the effects of extreme winds in the atmospheric boundary layer. The session commence with an insightful and thought provoking presentation from Keith Browning on the topic of sting jets. It was interesting to see what information can be gleamed from weather charts and a bit of inspiration! Arribas and Mylne followed this presentation by discussing the benefits of using ensemble prediction systems (EPS) to forecast extreme winds. An interesting discussion relating to the practicality of such forecasts both from a user's and economic value perspective ensued. Andrew Quinn examined a number of issues of particular reference to cup anemometry in high winds. Andrew clearly demonstrated the uncertainty that can be inherent in a number of cup anemometers which are often taken as the benchmark standard. Mark Sterling discussed a series of physical experiments undertaken in the lower part of the ABL in order to provide an insight into extreme pressure and velocity fluctuations. Using conditional sampling he argued that two possible scales existed with respect to pressure and the extreme events occur when these scales are superimposed on one another. The session was brought to a close by Roger Hoxey who outlined a method of interpreting the results illustrated in Mark's presentation by using discrete vortex structures. Using a simple Rankine type vortex Roger was able to show that the spectral properties of some turbulent parameters can be well represented by a limited number of vortices.

An extensive discussion followed the end of the morning session and it was heartening to see detailed questioning by both meteorologists and engineers.

Wednesday afternoon first session, Modelling Methods – Chris Baker

The first paper in this session was delivered by Andrew Orr on behalf of a team at University College, and discussed the meso-scale modelling of coastal wind jets. Calculations were made using the Met Office Unified Model with a horizontal resolution of 12km, and complementary experiments were carried out using a large rotating stratified flow tank. It was shown that in coastal regions low level jets could occur, with wind speeds 50 to 100% higher than might be expected, that were caused by a combination of the Coriolis effect and the roughness and elevation discontinuities at the coast. This has obvious implications for offshore wind energy production. Ruth McDonald from the Met Office then discussed possible changes in storm frequency due to various climate change scenarios, using the HadAM3P climate model. Comparisons were made with storm tracks and frequencies for the period 1960 and 1990 and good agreement was found for storm tracks and frequencies. The future simulations for 2070 to 2100 indicate that storm tracks will be shifted to

the south in winter with an increased frequency and strength. However there are still major uncertainties in these predictions and further work is required in this area. Jakob Mann then presented a paper on regional extreme wind climates, that used the WAsP methodology to derive regional extreme wind climates from measured time series, and eliminating local variables such as surface roughness, topography etc. The discontinuities between the fifty year wind speeds at national boundaries in the UK were considered. Finally some insurance based work was presented by Paul Rockett from Benfield Ltd, who described work into the uncertainty in wind storm loss evaluations. The uncertainty in windstorm vulnerability functions was modelled using generalised Gamma distributions, which enabled a consistent model for the variance in loss data to be derived. Taken together these papers indicated the importance of meso-scale wind climate effects to those involved in wind engineering practice, which is effectively at the micro-scale from the point of view of meteorologists.

Wednesday afternoon second session, Wind Engineering Applications - Roger Hoxey

There were five presentations under the heading of Wind Engineering Applications. The first, an invited paper by Nick Cook, presented rigorous statistical analysis of extreme wind speeds. The method presented avoids the issue of asymptotic convergence and associated errors by addressing the general penultimate form of the distributions. One of the arguments in favour of using the general penultimate FT1 fit is that it does not have an asymptotic value, whereas the generalised extreme value (GEV) method does have limits for which there is no physical reason or justification. Nick illustrated the method with data from mean-hourly wind speed measurements at Boscombe Down for a 30 year period.

The second paper, from Xiaolin Larson, explored ways of analysing global weather observations to predict design winds. The method is based on measured surface pressure corrected to one height (here mean sea level) from which the gradient wind speed is calculated. Velocity at 10 m height is then calculated using an appropriate transform which includes the gust averaging time. The paper is concerned with application to wind energy but the method can be used for more general wind engineering applications.

The third presentation was from David Deaves who looked at operational wind limits for transport systems. In this case, high wind speeds increased the risk of overturning of high-speed trains. The paper dealt with a method of assessing the risk and its reduction over a period of six months when driver training and testing was being carried out. Limitations were activated when a gust speed of 40 mph was recorded in the hour before speed testing and also when the forecast mean wind speed is over 30 mph. The analysis included the implications of convective gusts.

The fourth paper, presented by Chris Letchford, was on extreme winds in the mid-west United States. He demonstrated that the use of extreme-value analysis is affected by storm type. In this region of the US the dominant extreme wind is associated with thunderstorm activity and the collection and analyses of data needs to reflect this. Further analysis was identified to enable comparisons with earlier work.

The final contribution from Andrew Quinn on assessing site wind speed based on short-term measurements highlighted the way that site-specific conditions influence extreme winds. A method of analysing short-term records in comparison with longer term records from existing meteorological stations was presented together with an example using varying lengths of records from two met stations. The comparison show more reliable information is obtained from analysis of peak-hourly gusts than from mean-hourly wind speeds, as the mean-hourly speeds are more sensitive to local conditions.

In the evidence presented in discussions immediately following, I do wonder why we still concern ourselves with analysing observations made at a standard anemometer height of 10 m. These observations are susceptible to factors such as surrounding fetch, interference, changes over time as vegetation grows and is cut down, instrument reliability and serviceability, missing data etc. And what is of even more concern is that the mean-hourly wind speed is more sensitive to site conditions than is the short duration gust.

Conclusion

Wind speed measured at 10 m is not suitable for any rational form of analysis that ignores local site conditions. There is no rational basis for the continued refinement of methods such as

extreme value analyses. To overcome the difficulties associated with measurements at 10 m the alternative proposed to this conference and elsewhere is to estimate the gradient height wind speed from atmospheric pressure measurements. Reduction factors can then be applied to estimate the maximum gust speed within the boundary layer at any height. These methods are not precise but, for example if power-law approximations to extreme-gust wind speeds through the boundary layer are used, and these have a typical exponent value of alpha=1/15, sensitivity to height is limited.

This method has the advantage that there are many years of reliable pressure measurements and hence a more reliable estimate of the design wind speed for a site is available than is the use of an anemometer some distance from that site. This approach would have the added advantage of making meteorological models of weather systems directly usable by wind engineers in assessing local wind speeds.

Thursday morning first session, Bridges – John Owen

Here are just a few personal comments on the bridges session at WES2004. I don't want to bore you by describing the papers in detail, after all you can read them all in the proceedings, rather I want to make just one or two observations. First, on the face of it, the bridges session was small with only four papers. Does this mean that research on wind effects on bridges is over in the UK? Well don't write things off just yet, as all four papers were presented by young(ish) academics suggesting that UK universities may well have much more to offer in years to come. Furthermore, there was an emphasis on computational methods (3 of the 4 papers). Though such approaches may still be controversial, they are the focus of much research at the moment and the problems are slowly being overcome. Indeed, it was good to see the case study of computational methods applied to a "real" bridge engineering problem. Another feature common to most of the papers was international collaboration with the UK Universities collaborating with intstitutions in Canada, China and Singapore, the excellent work on bridge cable dynamics illustrating nicely the fruitfulness of this work. So, in summary, a small but thoroughly interesting session that gives hope that UK "wind on bridges" research may yet rise phoenix like from the ashes of former glories.

Thursday morning second session, Slender Structures and Unsteady Flow–Ian Taylor

Four papers were presented in the session on "Slender structures and unsteady flow", ranging from full scale measurements on tall buildings and towers, to wind tunnel studies into chimneys and theoretical investigations into damper performance. The presentations, given by both UK based researchers and international colleagues, provided some interesting results, using a range of techniques and raised some lively discussions.

Brownjohn presented results of measurements taken at the top of a tall building in Singapore. The measurements included anemometers to measure wind data and a GPS system to give a picture of the static and dynamic response of the structure. This data is intended to provide information for a local wind loading code of practise. The combined GPS and wind measurement system could resolve the dynamic structural displacements, although no obvious relationship could easily be determined. Roger Hoxey questioned the use of anemometry probes on the roof, but due to the nature of the building and the local surroundings, there were limited alternatives. It was acknowledged that the location was not ideal, especially in the local weather climate with measurement devices often irreparably damaged in monsoons and fried in thunderstorms. Nick Cook suggested that roof effects are well known and could the data be "calibrated" with a nearby meteorological station. Again, this was problematic due to the very local thunderstorms common in Singapore.

Yoshida et al also presented the use of a GPS system to measure static and dynamic wind response of a tower, in conjunction with an FE analysis to assess the integrity of structures during strong typhoons. The results of the hybrid analysis demonstrated stresses in the tower's structural members were in good agreement with strain gauge measurements. However the analysis was limited by the GPS data being most reliable only at amplitudes >2cm and frequencies <2Hz.

Chiu et al demonstrated the use of a simple hot wire technique for investigating unsteady flows in natural ventilation chimneys. In particular, the effects of gusts, possibly causing flow reversal in the chimneys was investigated, although this phenomenon highlighted the need for improvements in the measurement technique, as the temperature fluctuates in the chimney due to

the flow reversal. Buoyancy effects due to a temperature difference were also considered. However, questions were raised to whether the temperature difference would be affected by the hot wire probe and whether a calibration could be done to account for this. This was noted, but had not been accounted for in the experiments.

The final paper by Colwell et al presented results from theoretical study on liquid column dampers, assessing the effect of varying orifice diameter, for both a single DOF and 3-DOF system. The results indicate that orifice size had a direct effect on the damping characteristics, and that 60% or more reduction in vibration could be achieved. Nick Cook wondered if an "active orifice" could be used, with a shutter device at the top of the column, as this would prevent and head loss under large vibrations, and could also increase the damping effects. There was some debate over whether this would be of benefit, and had not been considered in this study, where orifice diameter had been the main focus.

Thursday afternoon third session, External and Internal Flow – Ian Castro

The final session on the Thursday was entitled 'External and Internal Flow', which in some senses disguised the content. There were three papers covering various aspects of room ventilation, followed by one which discussed re-location of an open circuit wind tunnel within the same room. The first two ventilation papers were from Masaaki Ohba's group at Tokyo Polytechnic University and in the first he presented a new orifice flow model which, together with simple anemometry data, could be used successfully to estimate total pressures at openings. His colleague, C. Hu, then discussed laboratory and numerical experiments on a cross-flow ventilated room, showing that a SST k-w model performed better than a standard k-e model. His videos showed a relatively steady flow within the room but significant large-scale unsteadiness in the wake, so one could question the extent to which any steady flow computation could capture salient details of both the wake flow and the surface pressure fields. In the third paper David Etheridge (Nottingham) showed how opening discharge coefficients depend crucially on the nature of the flow local to the opening. For long, chimney-like vents, he also found a significant effect of Reynolds number. Whilst the observations were not unexpected, they emphasise the influence of small geometrical features (e.g. flush openings, or not) and the importance of appropriate definition of pressure drop coefficients.

The final paper provided an entertaining, yet informative, finale for the day, which put delegates in just the right mood for the conference dinner later in the evening. The serious point made by the author (Peter Richards, from Auckland) was that the original non-symmetrical location of the tunnel within its room led to rather high turbulence intensities in the latter part of the working section, caused by unacceptably large low-frequency contributions to the spectrum. Data from a detailed laboratory model of the entire arrangement, and from some CFD, suggested that moving the wind tunnel to a more central location would solve the problem, as indeed it did.

Friday morning first session, Wind loads– Nigel Wright

Gordon Breeze, BRE

Presented wind tunnel tests investigating the effects of varying Reynolds number for flow over curved shapes. These used the standard approach of surface roughening to account for scale effects. Pressure contours were presented for smooth and rough cases. These did not produce the effects that the presenter expected which he attributed to the separation being laminar rather than turbulence.

Questions were raised about the nature of the upstream turbulence. Is the separation really laminar? Ian Castro stated that pressure contours were not the best way of identifying the nature of the separation.

Chris Letchford questioned whether laminar flow could exist in the flow.

Chris Baker stated that the concept of Reynolds number independence was questionable and he mentioned recent literature on this.

Paul Blackmore, BRE

Presented work on codification for curve building shapes based on the experimental work of the last paper. Having reviewed various international codes it had been concluded that there was a lot of disagreement between the codes so it was decided to undertake the wind tunnel study. Based on these results it was decided to propose a national amendment to the Euro Code which would be available in 2005.

Jenny Burton, University of Newcastle/BRE
Presented work on wind loading for conic roofs consisting of membrane structures. These had been investigated in a wind tunnel study and pressure coefficient contours were presented and analysed. Both open, closed and open/closed cases were presented along with comparison from predictions from TENSYS and Architen.

Antonio Aguiló
This presentation was motivated by the interest including wind power generation devices on buildings. CFD simulations of 2D flow over a semi-circular building were compare with full-scale measurements. There was some discussion of equilibrium and non-equilibrium. The presenter was also careful to present his sensitivity study to validate his work. He found that the RNG turbulence model was preferable to the standard k-ε model or the realizable version. He also made a very useful point that ascertaining whether CFD results are converged should involve examining residuals and values of key variables.

The work was now progressing to consider integrated wind power generation.

Graham Knapp
Presented work on assessing the usefulness of CFD in determining structural loading. CFD offered new features and the costs were continually declining. However, there was little confidence in the technique and the results were mainly steady-state. This work was considering what information structural engineers needed and how CFD might provide this. Suggestions were quasi-steady approaches, peak factors, extreme value analysis and load-response correlations. It was suggested that LES and DES might be the way forward.

Nick Cook drew attention to the 7 points in the wind loading code that had to be satisfied by a wind tunnel study. He felt that any CFD should also satisfy these and that RANS models did not do this. The only way forward would be LES. The presenter felt that RANS was currently the only feasible approach for consulting engineers. Roger Hoxey disagreed with Nick Cook's dismissal of quasi-steady approaches which he felt offered a way of using CFD analysis in practice.

Friday morning second session, Flow problems – Andrew Quinn

A very interesting session covering cubes, carriages and cows. The first two papers dealt with problems found modelling flow over bluff bodies in wind tunnels and CFD, particularly the difficulty in realistically representing turbulence. Paul Hayden showed how even carefully modelled boundary layers in the wind tunnel can develop spanwise vortex asymmetries which may significantly affect measurements. Peter Richards continued this theme with a reanalysis of full scale, wind tunnel and CFD results. This demonstrated clearly the effects of the various scales and types of turbulent vortices on parameters of interest to wind engineers and the challenges of effectively representing these in modelling studies.

The next pair of papers brought us very much back to the problems of practical wind engineering. Mark Sterling demonstrated how to most effectively topple the chairman with the buffeting of a passing high-speed train and how such issues should be of growing concern to everyone. This posed the challenge of how to effectively communicate wind engineering ideas to the general public and the railway industry so that serious research can be rationally undertaken. On the roads, Adam Robertson and John Rees illustrated how full-scale studies can be developed into meaningful design information for roadside structures and why such codes need to be constantly reviewed as new technologies and designs emerge.

The session was then enthralled by Chris Letchford and his development of a wind tunnel without walls for the study of flying debris (thankfully not including cows) in storms. Perhaps the use of aircraft engine wakes for demolishing buildings will be the way of the future? Certainly the development of a rational basis for impact testing of structures will help prevent the kind of destruction we are all too familiar with from recent tropical storms. Chris Baker, who concluded the session, had a similar objective and his approach showed how the beauty of differential equations could overcome the pollution of experiments (and the intractability of academics) to demonstrate that flying debris is a genuinely chaotic system.

❖ High winds on trains – the west coast modernisation project

There will be a technical meeting on the above topic at the Institution of Civil Engineers on Tuesday 2nd November at 6:00. The abstracts relating to the presentations are given below:

Enhanced permissible speed on the West Coast Main Line: Investigations of wind overturning effects. (Bill Bradbury, Atkins)
This presentation summarises the extensive campaign of research conducted by the WCRM project and Railway Safety into the stability of tilting trains in cross winds. This research was required in order to quantify the probability of overturning under the combined effects of cant deficiency and cross wind effects and hence to permit a tolerability assessment as required by Railway Group Standard GC/RT5021. An uncertainty analysis conducted in 2001 demonstrated that probability estimates based on the then available knowledge were subject to an uncertainty of two orders of magnitude and a conservative bias of a similar order. This precluded use of the estimates for the tolerability assessment. This uncertainty analysis allowed identification of the key sources of error due to inadequacies in modelling equations and input data – and this allowed prioritisation of the research activities required to address these inadequacies. The resulting targeted research activities included:

1. Wind tunnel testing (supported by theoretical analysis and full scale validation) in an atmospheric boundary layer wind tunnel with turbulence modelling and representation of embankments;
2. Theoretical frequency domain analysis to investigate the effects of moving through turbulence.
3. Vehicle dynamic work to investigate the dynamic amplification of gust wind loads.
4. Theoretical analysis to refine the wind probability model used to predict the probability of trains being exposed to excessive gusts occurring while trains are exposed.
5. Numerical analysis and full-scale measurements to determine local wind conditions allowing for large scale turbulence effects.

Setting the scene (Jim Lupton, RSSB)
The evening's presentations describe aerodynamics' research funded and managed by the Rail Safety & Standards Board (RSSB). The research forms a small part of the largest publicly funded rail research programme in Great Britain. Jim Lupton, Head of Engineering Research at RSSB, will give a short introduction to this research programme, explaining its scope and objectives, while setting the scene for the rest of the evening.

Wind survey of curves on the WCML (Andrew Quinn and Roger Hoxey, Silsoe Research Institute)
On site measurements of wind velocity have been carried out at eight sites (open track curves normal to the prevailing wind) designated by WCRM as of interest concerning extreme wind speed prediction. The objective of this study was to compare the wind conditions at the curve with those at one of two reference Meteorological Office anemometer sites and determine the typical relative values. Using these data, realistic (rather than conservative) once-in-50-year estimates of hourly mean and gust wind speed and direction were obtained. Local site extreme values estimated using direct ratios of target site hourly gust and reference site hourly gust were found to have the lowest uncertainty. The use of ranked data in forming these ratios was found helpful in reducing uncertainty. This method also removed the need for prohibitively large wind speed threshold criteria or extended measurement periods. Local site effects showed significant directional variation and measured values have been adopted wherever possible, thus removing any reliance on subjective estimation of parameters. Where such data is not known RACoP terrain category 2 is thought to be appropriate for height corrections, although this does overestimate the reduction with height between 10m and 3m for extreme wind data.

Full scale measurements – the world as a wind tunnel (Justin Jones, Atkins)
How does one measure loads of tens of newtons on a vehicle weighing over 40 tonnes? Add in the requirement that the system must be robust, easily maintained and ready in 5 weeks and the problem becomes more difficult. Atkins was asked by RSSB to produce a system to measure the force and moment on a railway carriage, as well as the wind and atmospheric conditions. The test site was located on the coast of Cumbria to give a smooth upwind profile for the measurements. A novel solution for measuring

the loads was developed which used a modified section of rail and commercially available load cells. Two load cells were located under the rail below each wheel, from which the lateral and vertical forces could be calculated. The use of the rail allowed the carriages to be rolled into place without the use of heavy lifting equipment. The data were logged continuously over two winters on different configurations of Mk3 and Pendolino vehicles, producing 900MB of data per week. The load coefficient versus angle results gave good agreement with subsequent wind tunnel tests carried out in a boundary layer wind tunnel.

Assessment of Train Overturning Coefficients Under Crosswind Through Wind Tunnel Investigations (Fernando Lopez-Calleja, BMT Fluid Mechanics Ltd)

A three-stage wind tunnel investigation has been conducted by BMT Fluid Mechanics to derive high accuracy overturning forces and moments acting on the West Coast Route High Speed Train under cross-wind conditions. The first phase of the study justified the use of 1:30 scale boundary layer wind testing for derivation of overturning moment coefficients under supercritical conditions by comparing pressure distributions at 1:30 and 1:7 scales. The second phase of the study consisted of parametric boundary layer wind tunnel tests that provided mean and gust overturning moment coefficients for a range of cant and tilt configurations, and for a range of embankment scenarios. Finally, the third phase of the studies provided a satisfactory back to back comparison of wind tunnel model scale and available full scale overturning moment coefficients. The boundary layer wind tunnel studies accurately represented full scale experimental conditions while applying the acquisition and analysis techniques used for the second phase of the studies.

Effect of orography on wind speeds over the route of the West Coast Line (Nick Cook, RWDI/Anemos)

Anemos Associates (now RWDI-Anemos) were contracted to provide analysis of the effects of orography on the wind speeds for the whole of the route from Euston to Glasgow. The analysis was performed using the well-known MS3DJH three–dimensional model on overlapping 10km-square tiles. The roughness-change model was generated automatically using the BREVe2 application. The orographic model was extracted from the Landform Panorama database under licence from Ordnance Survey. The results were compiled into abutting 5km-square tiles of design wind speed as Excel-compatible files and forwarded to the design team. The design team added the local effects of ground roughness and topography using their own established models.

❖ Report from EROFTAC SIG5

Hervé Moran writes:

The ERCOTAC SIG5 meeting was held at the University of Nottingham, UK, on September 9 and 10th, 2004. The object of this meeting was to revive the Special Interest Group 5 on Environmental CFD and bring together scientists and engineers from Europe to report on their recent work and what they viewed as the next challenges in the area of Urban Scale CFD. The material presented at this event will be uploaded on the SIG5 site soon.

As indicated in the report title the meeting was more specifically concerned with Urban Scale CFD and aimed to address modelling issues by considering various physical sizes ranging from what the organising committee simply called Small Scale, Intermediate Scale to Large/Mesocales. By small scale it was understood flow passed a single building or structure; intermediate scale suggested to look at groups of buildings, maybe a small district whilst large scale looked at a town. To balance the session, create further debate and remind everyone of the limitation of modelling and the role of experimentation a fourth session was held on the topic of Experimental Perspectives. Each of the session was open by a lead address given by recognised experts in the respective fields. These aimed to summarise the body of work in the various areas and launch the delegates' presentations and the workshop sessions.

Professor Ian Castro, Southampton, UK, opened the first day presenting results and challenges in the area of flow passed bluffed body and single buildings. It was explained that this situation is of course very unlikely and therefore links with the second keynote address were established.

Professor Richard Perkins, Central Lyon, France, opened the second session and presented challenges at the scale of a group of buildings, focussing on some recent work done in the area of pollution prediction and pollution control in Lyon.

On the Second day, Professor Julian Hunt, UCL, UK, addressed the floor and presented issues for

the City focusing on the mesoscale and meteorological features.

The final session was led by Professor Christopher Baker, Birmingham, UK, who invited the modellers to reflect on what is known and what can be measured in the field of wind engineering. A sceptical scientist when it comes to CFD modelling Professor Baker summed up very clearly what he thought CFD could contribute to in his field and areas where experiments led. It was also clear that both needed one another; that CFD could actually lead (to further) experimental research programmes.

Twelve technical addresses were subsequently presented in the four sessions and concerned:

- flow around bluff body
- flow over complex terrain
- wind alarm
- best practise in wind engineering
- pollutant dispersion in urban environments
- fire in tunnels
- experimental data collection
- validation

The meeting was well attended with over 50 delegates from 8 countries and various academic and professional affiliations.

The success of the event – which proved more of a mini conference than a workshop – and the numerous questions that stemmed from the debates that followed have convinced the committee of the need for regular meetings and the group is currently considering the next events. At the minute several options are being considered in the Netherlands or Germany and the scientific content discussed. Issues regarding the notion of extreme vs. means data, urban CFD and tree canopy, tall grass and the better integration between data collection and modelling are being discussed. Actions to list existing databases and bring together the data collected by the various programmes, groups or individuals on a common website are also envisaged to favour future workshop and validation exercises.

The attendance of numerous industrialists in the group made it clear for the organisers that there is a strong interest for the subject amongst consultants but that there is also a need for guidelines. Members of the organising committee at Nottingham are considering the organisation of a “mini course” to offer an overview of the “dos”, “don’ts” and the uncertainties in the field of atmospheric flow and wind engineering when it comes to modelling.

The scientific committee for the event was:

- Prof. Julian Hunt, UCL, UK
- Dr Peter Davidson, Cambridge, UK
- Dr Hervé Morvan, Nottingham, UK, SIG5 Coordinator

The local organisation committee was led by Dr Hervé Morvan and Rachel Ramsden. The support of the School of Civil Engineering and its CFD Group, at the University of Nottingham, are gratefully acknowledged.

ERCOFTAC SIG5 is most grateful for the involvement of all the delegates, and in particular the speakers and keynotes speakers whose efforts made the event successful.

❖ Recent Hurricanes

Sarah Jordan writes:

As of writing, the naming of this season’s Atlantic basin storms has reached *Nicole*. Eight of these developed into hurricanes, with the 4 most powerful hurricanes to hit land being Charley, Frances, Ivan and Jeanne. None of these were as costly as Hurricane Andrew in 1992, but because they arrived in quick succession the cumulative damage has been high. Their histories are described below.

Charley became a hurricane on 11th August passing just south of Jamaica where it killed one person the next day. It made landfall on Cuba at Playa del Cajio on the 13th with wind speeds of 120mph (Category 3 on the Saffir-Simpson Hurricane Scale), and took nearly 3 hours to move over western Cuba coming to within 15 miles of the capital, Havana, and causing at least 3 deaths. It weakened over the Straits of Florida, passing over the Dry Tortugas as a Category 2 hurricane, then accelerated towards the southwest coast of Florida. Charley intensified to a Category 4 hurricane just before it reached land southwest of Fort Myers, resulting in the barrier island on Fort Myers Beach being swamped with seawater. The maximum sustained winds that evening were estimated as being 145mph. The hurricane’s eyewall crashed into Punta Gorda and Port Charlotte leaving few buildings untouched before traversing the central Florida peninsula leaving a trail of destruction behind. It was still a hurricane when it reached

the northeast Florida coast, although of a reduced intensity. It made landfall again on the 14th near Cape Romain in South Carolina with maximum wind speeds of about 80mph, then the centre moved offshore, but returned to land at North Myrtle Beach, South Carolina. Whilst passing over southeastern North Carolina it weakened to a tropical storm. It had caused at least 30 deaths and made thousands homeless.

Frances became a hurricane on the 26th August in the central tropical Atlantic and strengthened steadily. On the 1st September it had reached the southeastern Bahamas; the next day it was battering the Turks and Caicos Islands with 145mph winds (Category 4), and then passed over San Salvador as a Category 3 hurricane. On the 3rd and 4th it moved through the northwestern Bahamas with Category 2 winds. The eye of the hurricane reached the US near Stuart on the east coast of Florida on the 5th, and as it crossed the central Florida peninsula it weakened to a tropical storm, reaching the Gulf of Mexico early on the 6th. Frances made another landfall later that day near St Marks, Florida, still as a tropical storm, then moved northward and dissipated over Canada. Frances was a storm the size of Texas and nearly 2 million people left their homes in Florida's largest evacuation.

Ivan developed into a hurricane early on the 5th September, and after travelling westward it reached the southeastern Caribbean Islands on the 7th. It wrecked the island of Grenada, killing more than 37 people and making about 60 000 of its 95 000 inhabitants homeless. Grenada's capital, St George's, experienced winds of 125mph. Ivan became a Category 5 hurricane early on the 9th as it was over the central Caribbean Sea, but as it approached Jamaica it weakened to Category 4 and the eye of the hurricane veered away to pass south of the island. Nevertheless, it caused more than 20 deaths in Jamaica. Ivan regained Category 5 strength for a brief time on the 11th when it was south of the Cayman Islands, but was downgraded to Category 4 as it struck Grand Cayman Island on the 12th. It had strengthened to a Category 5 hurricane for the 3rd time when it pounded the western tip of Cuba, although the centre remained offshore. The evacuation in Cuba was the largest in its history. Ivan then moved across the Gulf of Mexico weakening slowly, and made landfall in the US near Mobile, Alabama, early on the 16th as a Category 3 hurricane. It then made a large clockwise loop over the next week, and as it did so at least 12 tornadoes came from it. Next it moved northeast over southeastern US and reached the Atlantic on the 19th as an extratropical low. However, this wasn't the end of Ivan, as it went on to move down along the US coast then across south Florida and reached the Gulf of Mexico on the 21st. It was upgraded to a tropical storm on the 23rd whilst south of the mouth of the Mississippi River, but when it made landfall again in Louisiana the next day it was as a tropical depression. Ivan finally dissipated over Texas. This has been the most powerful storm this season and has caused over 110 deaths.

Whilst Jeanne was categorised as a tropical storm it passed across the Virgin Islands and Puerto Rico on the 15th September, causing more than 1 death in Puerto Rico. Whilst over the Mona Passage (between Puerto Rico and the Dominican Republic) Jeanne became a hurricane for a short time but weakened over Hispaniola; it caused the deaths of more than 11 people in the Dominican Republic. On the 17th it hit Haiti causing the deaths of over 1 500 people; torrential rain and rising flood waters resulted in entire cities being submerged. Most people were killed by the flooding, but mudslides also contributed to the death toll. Jeanne then moved over the southeastern Bahamas as a tropical storm, and after travelling north moved in a slow clockwise loop until the 23rd by which time it had become a Category 2 hurricane. Jeanne struck the northwestern Bahamas on the 25th and strengthened to Category 3, then its large eye made landfall in the US near Stuart, Florida. It had been less than three weeks since the eye of Hurricane Frances had made landfall nearby. Whilst passing over Florida Jeanne was downgraded into a tropical storm. This has been the deadliest storm of the season so far, due to the destruction it wreaked in Haiti.

http://news.bbc.co.uk/2/hi/business/3699300.stm
http://news.bbc.co.uk/2/hi/americas/3557180.stm
http://news.bbc.co.uk/2/hi/americas/3562948.stm
http://news.bbc.co.uk/2/hi/americas/3630180.stm
http://news.bbc.co.uk/2/hi/americas/3634898.stm
www.nhc.noaa.gov/archive/2004/IVAN_graphics.shtml
http://www.moreweather.com/tropics/2004/Charley/
www.nhc.noaa.gov/archive/2004/tws/MIATWSEP_sep.shtml
http://www.srh.noaa.gov/data/SHV/CLMSHV

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❖ Visiting Professor Inaugural Lecture

The University of Birmingham is pleased to announce that Roger Hoxey has been made a visiting professor. To celebrate this achievement, Roger will deliver an inaugural lecture on the 17th November at 2:00pm in the School of Engineering. The event is free to attend and all are welcome. For catering purposes we ask that those who intend on attending please contact Ms Lesley Boyle on 0121 414 5137. Brief details of the presentation are given below:

Full-scale wind load measurements - the epilogue from Silsoe.
I intend to look back over 30 years of full-scale measurement, assess the benefits and drawbacks, and discuss where to go from now. I will discuss the comparisons with wind tunnel methods and CFD and again suggest future work.

The properties of the atmospheric boundary layer are fundamental to this work hence there will be discussion of measurements made near the ground, the indicators of coherent flow structures, and how this information can be used in wind engineering.

The presentation will be based on experiment measurements and what we have learnt from the experience of making full-scale measurements. This leads to questioning some approaches that have been widely used in wind engineering.

❖ About WES

ICE Support
We are pleased to announced that our contact at the Institution for all administrative support is Caroline Howe. Caroline can be contacted at
Tel: 020-7665-2238
Fax: 020-7799-1325
e-mail: Caroline.Howe@ice.org.uk
WES website www.ukwes.org

❖ Forthcoming WES Meetings

The following meetings are have been proposed. Unless stated otherwise all meetings will be held at the ICE from 6 pm.

2 November 2004 Rail aerodynamics.

2 February 2005 Wind tunnel projects.

3 May 2005 This year's windstorm and AGM.

7 September 2005 University Day

2 November 2005 9th Scruton Lecture

❖ Other Forthcoming Conferences

2005

- **10th Americas Conference on Wind Engineering (10ACWE)**
  Baton Rouge, Louisiana, U.S.A., May 31 - June 4, 2005
  http://www.10ACWE.lsu.edu

- **EACWE 4. The fourth European & African Conference on Wind Engineering.**
  Prague, 11-15 July, 2005
  http://www.itam.cas.cz/eacwe2005

- **The sixth Asia-Pacific Conference on Wind Engineering (APCWE VI)**
  Seoul, Korea, September 12-14 2005
  http://apcwe-vi.kaist.ac.kr

2007

- **12th International Conference on Wind Engineering (ICWE12)**
  Cairns, Queensland, Australia, 1 – 6 July
  www.awes.org/icwe12

❖ Contact Point

Contributions and responses to:


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Please help to fill this space by contributing news clippings, people news, details of key projects or facilities that might interest others or notices of new books and meetings.

❖ Job Vacancies

THE UNIVERSITY OF BIRMINGHAM

THE UNIVERSITY OF BIRMINGHAM,
SCHOOL OF ENGINEERING
(CIVIL ENGINEERING)

Lecturer / Senior Lecturer in Structural Engineering

The Department of Civil Engineering (with an RAE rating of 5) seeks to appoint a Lecturer / Senior Lecturer in the field of Structural Engineering – ideally in the field of steel structures, although candidates from all branches of the discipline would be welcome.

Duties will include undergraduate teaching in Structural Engineering and Design, taking an active role in some aspects of the administration of the Department and taking forward the long-established research work in Structural Engineering.

Informal enquiries can be made to Professor Chris Baker, Head of Civil Engineering, e-mail: c.j.baker@bham.ac.uk or telephone: 0121 414 5067.

Starting salary on scale £23,643 – £42,573 a year depending on experience and qualifications. The post is available from 1st January 2005.

Application forms (returnable by 19th November 2004) and details from Personnel Services, The University of Birmingham, Edgbaston, Birmingham B15 2TT. Tel: 0121 415 9000, web: www.personnel.bham.ac.uk/vacancies Please quote reference G19328.