Making WAVES across the country

Wind Action, Ventilation and Environmental Science (WAVES): Silsoe-Birmingham Research
Dr Andrew Quinn

Analysing wind and the effects of win on buildings and structures is key to the success of any new build. Dr Andew Quinn's many years of experience in wind, structural and environmental R&D, developed at the old Silsoe Research Institute in Bedfordshire, lives on at the University of Birmingham. Under the Silsoe~Birmingham Research venture, organisations and researchers are able to take advantage of the internationally renowned, full-scale test site at Wrest Park, Silsoe, Bedford. Facilities include the Silsoe Structures Building and a 6m rotating cube structure, for testing and research purposes.

The evaluation of wind effects on buildings and structures has been a speciality at the test site for over 30 years. The site is extremely well documented for its wind conditions and has been the focus for experimental campaigns that are now considered standard test cases for wind engineering in wind tunnels and for computational fluid dynamics (CFD). Full-scale testing remains important because of the need to provide definitive, 'benchmark' studies and validations for structures, under real conditions. This is especially valid where wind conditions have high Reynolds number, or where novel designs or features cannot be effectively scaled for model testing.

Although the focus of Birmingham~Silsoe is on full-scale studies of wind loads on buildings and building components, recent activities have included wind-induced fatigue loading of structures, ventilation of buildings (natural and mechanical), vehicle aerodynamics, dispersion of aerial pollutants and wind energy. Wind energy is a growing area: Birmingham researchers have worked with both 'standard' gable and roof-mounted turbines and investigated the potential augmentation of wind energy using profiled appendages added to a building. The Birmingham~Silsoe team also asseses wind-energy resource for new sites and is working on new methods to improve assessment techniques, to reduce lead time and improve accuracy.

The work on site has been funded through a mixture of fundamental science research grants, applied work for government departments and industrially-funded studies. This research has included the development of new measurement techniques, data analysis methods and robust experimental procedures for many types of study. All this allows Dr Quinn and his colleagues to undertake a wide variety of challenging studies on real structures with a high degree of success. Furthermore, bespoke, client-site testing in the UK and overseas has provided opportunities for understanding and validating extreme wind predictions at remote sites for Network Rail; wind surveys of the 2012 London Olympic stadium site; vehicle-induced pressure loading on tunnel linings; and studies of the effects of vehicle aerodynamics on infrastructure.

Testing at the Olympic park construction site

Facilitating this work are a large number of specialist instruments, including over 20 ultrasonic anemometers, ideal for accurate measurements of turbulence in both high and low wind conditions, pressure-measurement equipment for both surface and free-stream pressures, enabling detailed surveys to be undertaken over structures, and force or strain measurements within building elements.

Dr Quinn and his colleagues are always looking for new opportunities to collaborate with other researchers, for knowledge transfer, and to provide data and analysis to commercial clients. Custom-built equipment can be developed for specific applications and/or tested for before deployment in a real environment, under expert supervision, enabling high-quality, high-accuracy consultancy as well as specific research & development to take place. The Birmingham team includes Dr Quinn, Professor Roger Hoxey, Dr Adam Robertson, Dr Mark Sterling and Professor Christopher Baker.