December 2013

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THE WIND ENGINEER

NEWSLETTER OF AMERICAN ASSOCIATION FOR WIND ENGINEERING

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International Association for Wind Engineering

Comparison of Microburst-wind Loads on Structures Including Scale Effects

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Microburst can produce downdraft and strong divergent outflow wind, whose characteristics are distinct from the atmospheric boundary layer (ABL) wind. Statistical summarization of the meteorological studies suggests that the flow field of a microburst at its maximum-wind producing status shares many similarities with the laboratory impinging jet flow. Besides the wall-jet-like outburst flow, the microburst also

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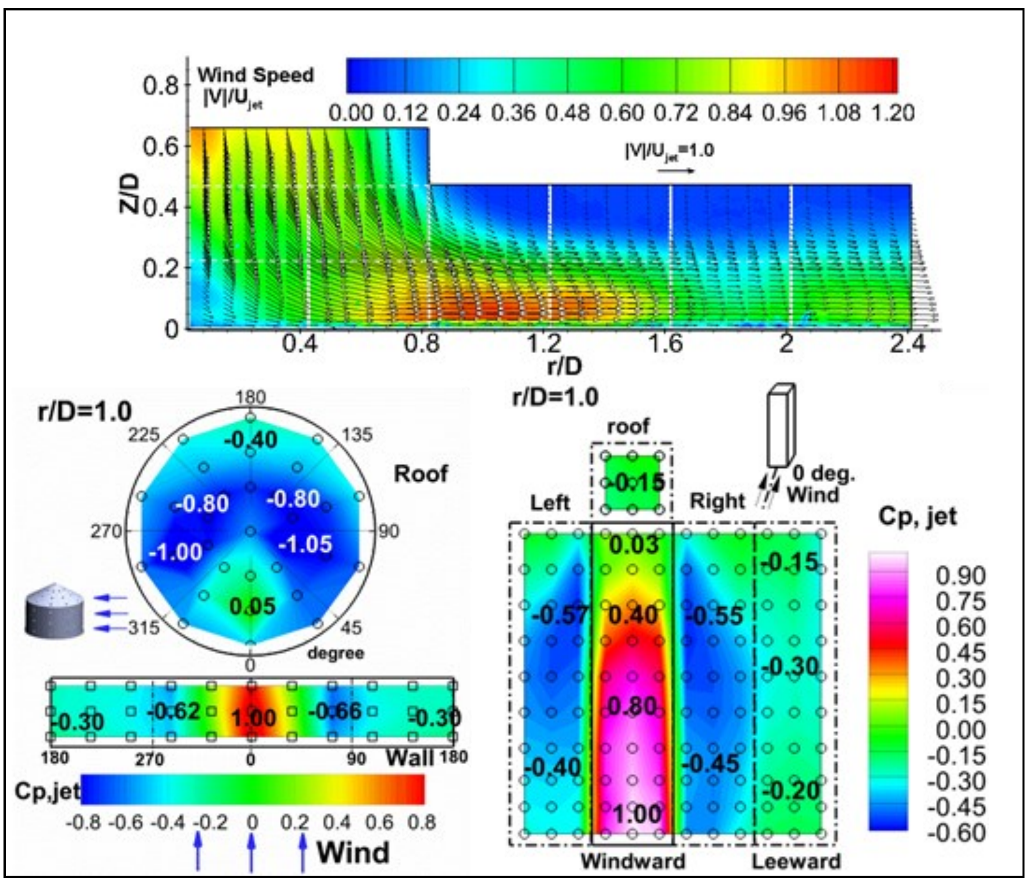

Figure 1: Mean wind speed and pressure distribution on a grain bin model and a high-rise building model at r/D=1.0

(Continued from page 1)

produces high static pressure in the core and large turbulence in the divergent outflow. Because of these unique flow features, the microburst wind could be potentially dangerous to civil structures which are normally designed to resist the conventional ABL wind.

In the present study, microburst-wind loading effects on four different low-rise structural models and a high-rise building model are evaluated and compared by performing laboratory tests. The microburst flow field was simulated using an impinging jet simulator at Iowa State University. Velocity and turbulence intensity profiles at selected locations are revealed. Both mean and dynamic wind loads are studied in detail and found to be dependent on several parameters, including radial location, orientation, and geometric shape.

In general, a structure experiences high external pressure and large downward force if a microburst occurs near the location of building, such as r/D≈0.0 and 0.5. In the outburst region, the distribution of pressure coefficients was basically similar to those obtained in ABL wind for the low-rise structures. For low-rise structures, geometric shape plays a key role, when the building models were in the outburst region. Circular cross-section and streamlined roof shape help reduce the drag coefficient, but induce larger uplift force coefficient. For the high-rise building model, microburst induces an inverse pattern of mean wind loads compared to that induced by the ABL wind. The local force fluctuation is found to be larger at higher elevations (z/H>0.5) and further radial locations (r/D=1.5 and 2.0). Finally, it is also found that the effect of geometric scale of a model on the mean wind loads in the outburst region is minor when it is within a blockage ratio of 3% as tested in the present study.

Experimental investigation of wind-induced vibration of slender tapered cylinders

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Slender cylinders are frequently used as structural members. However, many of these cylindrical elements are susceptible to wind excitation and only a limited number of studies have been performed to study those of tapered cylinders, especially those with non-circular cross-sections. To understand tapered cylinder vibration, a long-term, full-scale experiment has been conducted to monitor the vibration of a number of traffic signal support structures, which have slender tapered cylinders of either circular or multi-sided cross-section. To supplement the findings from the full-scale study, a series of wind tunnel tests were conducted to study wind loading of tapered circular and multi-sided cylinders.

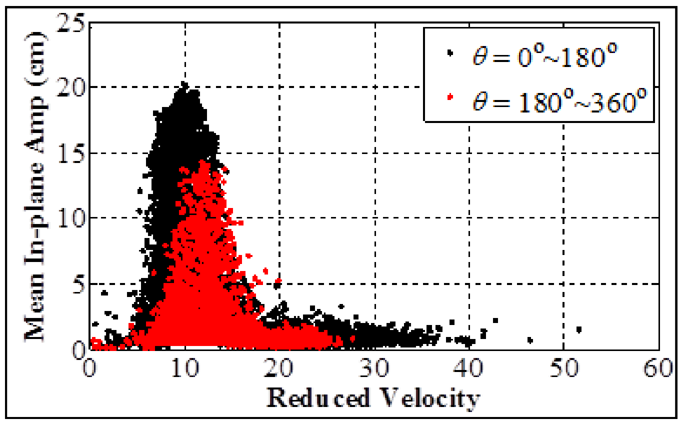


Figure 1: Vibration amplitudes vs. reduced velocity

The full-scale study revealed that the most problematic vibrations are likely due to vortex-shedding. For example, Figure 1 suggests that for a traffic signal support structure with a tapered circular mast arm, no matter whether the wind approached from the front side (θ=180°~360°) or the back side (θ=0°~180°) of the traffic signals, the large-amplitude vibrations occurred over narrow ranges of reduced velocity calculated based on the wind component normal to the arm. This is a strong indication that the vibrations were locked in with vortex shedding. The observation in the field has been confirmed in the wind tunnel study, in which section models of the mast arm with an attached traffic signal cluster were tested. Figure 2 shows that the Strouhal numbers of the model with the traffic signal model located in the windward (β=90°) and leeward side (β =270°) are consistent with the reduced velocity ranges over which the full-scale structure exhibited large-amplitude vibrations.

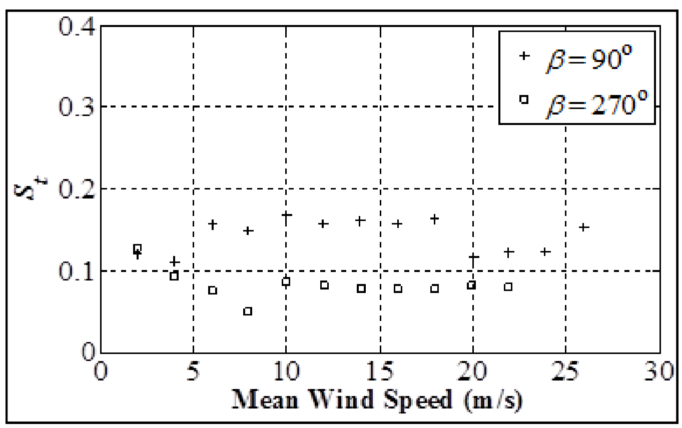
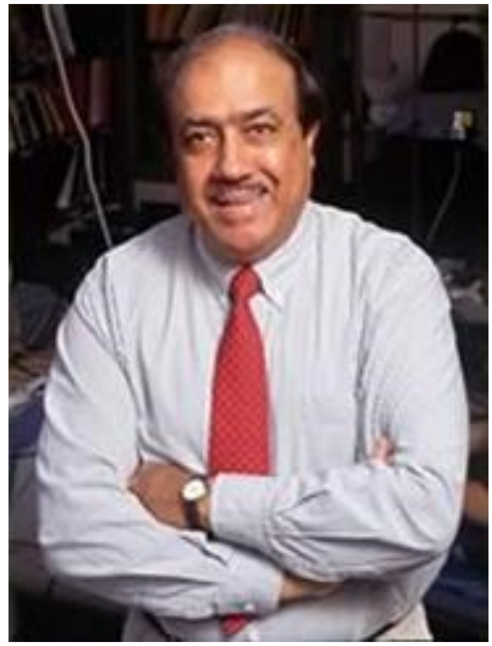


Figure 2: Strouhal number vs. mean wind speed

With the excitation mechanisms identified using the full-scale and wind tunnel studies, effective and efficient mitigation strategies for the problematic vibrations can be further developed.

Kareem Appointed as High-end Consultant to Chinese Universities and Received an International Distinguished Research Award from IASSAR

Ahsan Kareem, the Robert Moran Professor of Civil Engineering and Geological Sciences at the University of Notre Dame, is appointed by the State Council of the People's Republic of China as a high-end consultant to Tongji University, which boasts the country's top program in civil engineering. Tongji University has not only a large pool of highly talented students with strong background in math and science but they also have the best facilities with the most sophisticated wind tunnels and the largest shaking table in the world for earthquake engineering. This is the highest level of appointment currently given to a foreign expert in China. This involves advisory role for their research activities, evaluation of their current National Science Foundation's projects and lecturing. This also provides Kareem access to their intellectual as well physical research infrastructures.



Ahsan Kareem

This summer, Kareem was also named a recipient of the Distinguished Research Award by the International Association for Structural Safety and Reliability (IASSAR). The IASSAR promotes the study, research and applications of scientific principles of safety, risk and reliability in the analysis, design, construction, maintenance and operations of structures and engineered systems. Presented every four years, its Distinguished Research Award is given to senior researchers in recognition of outstanding contributions in the field of structural reliability and safety.

Request for Nominations

AAWE Award Nominations

The AAWE Best Paper Award is a recurring annual award. Please consider papers that have been or will be published in 2013 for possible submission for the next opportunity to present this award.

Nominations for the next Best Paper Award are due before January 31, 2014. Please send all nominations to the AAWE Awards Committee Chair, Anne Cope at acope@ibhs.org.

IAWE Award Nominations

The International Association for Wind Engineering awards process has recently changed from a quadrennial nomination, review and award period to an annual process, with nominations due on or before March 31 each year. Please consider nominating fellow AAWE members for these two prestigious IAWE awards:

- IAWE Senior Award (Davenport Medal), which is presented for a record of outstanding achievement, normally within the previous ten-year period, in at least two out of: i) significant and original contribution to wind engineering research; ii) applications to wind engineering practice; iii) educational contributions in the field of wind engineering; iv) international community involvement.

- IAWE Junior Award, which is presented for a record of outstanding achievement, within the previous five-year period, in at least one of: i) significant and original contribution to wind engineering research; ii) applications to wind engineering practice; iii) educational contributions in the field of wind engineering. Nominees should be under the age of forty years on January 1st of the year.

Nominations for the IAWE awards can be sent directly to the IAWE Secretary General, Shuyang Cao at cao@arch.t-kougei.ac.jp, or for assistance with submission you may contact the AAWE Awards Committee Chair, Anne Cope at acope@ibhs.org.

American Association for Wind Engineering

Established in 1966

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