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October 2007

Air Quality Considerations when Designing a Residential or Office Building. See page 8

Americas Conference on Wind Engineering to be held in beautiful Puerto Rico.

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Wall Wind FIU

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Abstract:

The U.S. coast from Maine to Texas is vulnerable to hurricane impacts. The human and financial toll from hurricanes of the last few years has been immense, with thousands of lives lost and billions of dollars worth of property destroyed. The public's belief in the effectiveness of its built environment and its ability to withstand the forces of nature has been shattered. Coastal residential buildings and structures are vulnerable to damage from hurricane induced wind, rain, and debris, whose combined impacts are not well understood. Damages during extreme wind events highlight the weaknesses inherent in coastal residential buildings and underscore the need for improving their structural performance. This article provides an overview of an innovative research program that will develop hurricane mitigation techniques by testing low-rise residential structures under simulated hurricane effects. The research undertaken by the International Hurricane Research Center at Florida International University focuses on developing a full-scale wind-rain-debris testing facility, the first-of-its-kind, to revolutionize coastal building construction and retrofitting practices.

Wall of Wind Hurricane Research at Florida International University

1. Hurricane Losses Loom

Catastrophic loss due to hurricanes is the largest and most pervasive risk faced by the U.S. Gulf and East Coast from Maine to Texas. Hurricane-induced economic losses have increased steadily in the U.S. during the past 50 years with estimated annual losses (in constant 2006 dollars) averaging \$1.3 billion from 1949-1989, \$10.1 billion from 1990-1995, and \$35.8 billion per year in the last five years (National Science Board- NSB 2007). Recent hurricane activity and especially the New Orleans disaster in the wake of Katrina have focused public attention on this problem.

Historically, almost half of the national wind damage occurred in Florida, which now has \$1.5 trillion in existing structures exposed to potential hurricane devastation. With approximately 85% of the rapidly increasing population situated on or near the 1931 kilometers (1200 miles) of coastline, and no point farther than 105 kilometers (65 miles) from the coast, Florida losses will continue to mount in proportion to state population density. The 2004 hurricane season resulted in insured losses in excess of \$20.5 billion, with Florida accounting for

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85% of that financial loss. The devastation brought by the hurricanes that recently impacted Florida and other coastal states demonstrates the need for mitigation tools that can significantly reduce losses.

The majority of coastal residential construction performs well under gravity loads, but significant damage has been observed after major wind events such as tropical storms and hurricanes. Damages during extreme wind events highlight the weaknesses inherent in current residential building construction and underscore the need for improving the structural performance of typical residential buildings. Also, there is a tremendous concern for the existing stock of old buildings that are not sufficiently designed to an acceptable building code or not constructed to an acceptable quality.

Full-scale testing on residential building models subjected to simulated hurricane induced effects such as high winds, wind-driven rain, and flying debris can lead to better understanding of hurricane-structure interaction and can lead to innovative design technologies that can mitigate hurricane wind damage. The International Hurricane Research Center (IHRC) at Florida International University (FIU) has developed a new research approach to better understand hurricane-induced effects on residential buildings and other structures through full-scale testing. This research will facilitate the development of advanced mitigation techniques by studying the responses of test models of representative building structures or appropriate portions of such structures when subjected to hurricane-induced wind-rain effects in a controlled and repeatable environment using the Wall of Wind testing apparatus. Full-scale testing in conjunction with debris generation will help to study the initiation and impacts of flying debris on test models. The facility will be open for cooperative research purposes to interested parties around the world.

2. Background of Large Scale Wind Test Facility

The "Three Little Pigs" at the University of Western Ontario in Canada and the Cyclone Testing Station at James Cook University in Australia (Xu, 1995) are valuable facilities capable of performing full-scale destructive testing on residential buildings under pressures created by pressure box or actuator loading. However, currently no facility simulates an actual flow field that can (a) engulf a whole full-scale building and (b) replicate all the complex wind-structure interactions that occur in natural winds and affect a building's main wind-force resisting system as well as its components.

In 1999, the Idaho National Engineering and Environmental Laboratory (INEEL), through the U.S. Department of Energy (DOE), proposed that a large-scale wind test facility (LSWTF) be constructed to study in full-scale the behavior of low-rise structures under simulated extreme wind conditions. The cost of constructing this LSWTF was cited in various sources as $70 million to several hundred million dollars (INEEL, 1998). At the request of the Idaho Operations Office of DOE, the National Research Council (NRC) established a committee to review the potential value of an LSWTF (NRC, 1999). The 14 members of the study committee were well-known engineers and scientists with expertise in the following areas: wind-structure interactions, large-scale engineering research facilities, performance of non-engineered structures, characteristics of extreme winds, and wind-damage reduction.

The committee acknowledged that although much valuable information can be developed from wind-tunnel tests of small-scale models, computational simulations, and other techniques, the complex interactions that occur within a total structural assembly subjected to extreme winds can only be determined by large-scale or full-scale experiments. Thus LSWTF could play a role in expanding knowledge, improving current practices, and providing demonstrations. But the committee highlighted that experiments conducted at an LSWTF would be only one component of a national wind-damage reduction program. In that context, it is clearly important to ensure that the costs of building, operating, and maintaining an LSWTF do not preclude the development and application of other effective facilities, tools, and techniques. The committee concluded that the proposed LSWTF was an extremely costly method of producing data that would address only a fraction of the issues in wind-damage reduction. It was recommended that the U.S. Department of Energy not proceed with funding and constructing the large-scale wind test facility.

3. Wall of Wind Hurricane Simulation and Damage Mitigation Research

Coastal residential buildings and structures are vulnerable to damage from extreme windstorm effects such as hurricane induced wind, rain, and debris. The combined impacts are not well understood. It is extremely difficult to capture all the intricate flow separation, vortex generation, and reattachment phenomena around building structures and their effects on individual components and connections built with real materials unless they are subjected to a full-scale wind field with reasonable aerodynamic parameters. Significant advances could be made in construction practices, if the performance of a total building system could be evaluated in a full-scale turbulent flow field reasonably representative of a hurricane event, including combined

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effects of wind, rain, and debris. Effective design of building components and connections, imperative to windstorm damage mitigation of new and existing buildings, needs the development of an innovative research and testing facility that will simulate hurricane induced effects and perform full-scale experiments to identify weaknesses of structural and architectural components. Such a facility would generate experimental data for better engineering based on scientific understanding of the effects of extreme winds on residential structures. With the full-scale wind testing facility, full-sized residential structures could be tested under a range of hurricane conditions with reasonable representations of wind, rain, and debris.

Recognizing that full-scale testing will be advantageous but should not be an overly costly method of producing data, the research team at the IHRC (with contributions by Dr. Tim Reinhold, now at the Institute for Business and Home Safety - IBHS), started planning in 2003 to build a full-scale wind testing facility, at a much lower cost as compared to the INEEL-conceived LSWTF. With this full-scale testing facility, referred to as the Wall of Wind, full-sized structures such as site-built or manufactured housing, and half-sized small commercial and industrial buildings, could be tested under a range of storm conditions in a controlled and repeatable environment. The Wall of Wind testing facility will enable experimental identification of weaknesses in real structures and components subjected to hurricane induced wind and rain. Debris generation, trajectories and impacts on downwind buildings can also be tested. This new testing facility, the first-of-its-kind, may revolutionize building construction and retrofitting practices. Through full-scale destructive testing, failure-mode investigation and better engineering, innovative mitigation techniques and products can be developed.

The research team at the IHRC has already conducted initial full-scale testing with a 2-fan Wall of Wind, funded by the Florida Division of Emergency Management (FL DEM), that generates up to 54 m/s (120 mph) sustained winds and includes a water-injection system to simulate wind-driven rain under hurricane conditions (Leatherman et al., 2007; Gan Chowdhury and Leatherman, 2007). The IHRC research team has performed numerous tests (Gan Chowdhury et al., 2007) including performance testing of light commercial structural roofing (deformation of metal roof edge fascia shown in Figure 1a). The research team tested performances of several hurricane damage mitigation products such as comparing performances of common 'blue tarp' covering and that of new commercial products developed for patching damaged portions of roofing after a hurricane event to inhibit further degradation and water infiltration. The research team has also examined soffit failure and monitored the rain entering under the eaves of the roof, which often results in the collapse of ceilings, saturation of dry wall, and the infestation of mold; billions of dollars of damage to houses have been caused by this type of failure in the recent past.

A larger and more powerful 6-fan Wall of Wind (Figure 1b) has been constructed on the FIU Engineering campus. Initial testing has been performed on residential roofing with conventional barrel tiles (roof tiles breaking-off shown in Figure 1c). The 6-fan Wall of Wind is expected to generate up to 58 m/s (130 mph) sustained wind and will have a wind stream of about 7.3 m (24 ft) wide and 4.9 m (16 ft) high to engulf a small single-story building with real components, to be mounted on a turntable enabling wind test for different angles of attack. This larger facility, named RenaissanceRe Wall of Wind, is sponsored and supported by RenaissanceRe Holdings Ltd., one of the largest international property catastrophe reinsurers. RenaissanceRe has also provided financial support for constructing a 30.5 m (100 ft) long x 24.4 m (80 ft) wide x 10.7 m (35 ft) high prefabricated steel building to house the RenaissanceRe Wall of Wind, test building, instrumentation and auxiliary equipments.

The accuracy of the Wall of Wind full-scale testing and its success in helping to understand wind-structure interaction and mitigating hurricane effects will depend on the fundamental development aimed at generating a wind field that reasonably resembles mean and turbulence characteristics of real wind hurricanes. Being a member of the Florida Coastal Monitoring Program (FCMP), the IHRC possesses invaluable high-resolution surface wind data, collected during many hurricanes (e.g., Floyd, Francis, Isabel, Ivan, Jeanne, etc), that are being analyzed to estimate mean wind and turbulence characteristics and their variability from storm to storm. These estimates will be used to assist in simulating hurricane fluctuating wind in the full-scale testing facility through the use of active and passive control devices (independently computer-controlled fans and/or flaps, screens, etc) to assure that test flow conditions are representative of those occurring in a variety of actual wind storms.

Transient flow field characteristics such as those occurring in hurricanes have been simulated in small scale laboratory experiments by utilizing multiple-fan array driven by AC servomotors - each fan being individually computer-controlled to generate flow characteristics that can be easily modified and adjusted as prescribed (Ozono et al., 2006). In these multiple-fan systems, sharp changes in gust magnitudes were successfully simulated. The Wall of Wind testing system is similar to these multiple-fan systems, except that it is a full-scale wind simulator unlike the small-scale simulators

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developed so far. Methods already proven for small scale experiments will be used for the generation of velocity profile, turbulence, and gust effects for the full-scale facility. Rapid variation of the fan engine speed achieved by servo-control will help to simulate longitudinal turbulence, and actively oscillating bi-directional airfoils operated by actuators will enhance the control of vertical and lateral turbulence components in the flow through multiple sinusoidal control functions.

Figure 1a

Figure 1b

Figure 1c

Figure 1 (a) Pilot Testing on Roof Fascia with 2-fan Wall of Wind, (b) RenaissanceRe 6-fan Wall of Wind, (c) Roof Tile Testing with 6-fan Wall of Wind

4. Innovative Research Reducing Hurricane Losses

Understanding storm-induced effects on structures through the Wall of Wind full-scale testing, performance-based evaluation and failure-mode investigation is expected to stimulate development of mitigation techniques and products for buildings and structures to enhance resiliency of coastal communities against windstorms.

4.1 Development of Retrofit Techniques

Retrofit technologies can be examined by wind tunnel scaled model and/or component testing, but their true effectiveness and actual value to the safety of the building system can in many instances be better determined by testing a full-scale, complete or holistic system. Using the Wall of Wind, retrofit and mitigation techniques can be validated in a controllable and repeatable full-scale environment and without passively waiting for a storm to pass a test building site. For instance, aerodynamic roof edge products can be examined at full scale in the Wall of Wind for their effectiveness in eliminating or suppressing vortices that would otherwise form along most of roof edges of conventional shapes (Lin and Surry, 1993). Such products are expected to lessen uplift pressures and attendant damage to roofs. Most of the $16 billion in damages caused when the category 1-2 Hurricane Wilma struck South Florida in October 2005 were to roofs, and it is estimated that a significant amount of losses could have been prevented by such mitigation techniques.

4.2 Development of Hurricane Resistant Materials

Wall of Wind full-scale testing will permit examination of new hurricane-resistant materials, such as advanced composites. The Wall of Wind will be a state-of-the-art facility that will simulate the actual hurricane-induced aero-hydrodynamic effects on building materials to test their performance as integral parts of the full-scale structure subjected to hurricane wind and driven rain. Claddings with new high technology composite materials are also expected to be able to resist hurricane debris impact, and can be examined and verified in the Wall of Wind subjected to wind, driven rain and flying debris.

4.3 Development of Hurricane Resistant Connections

Most of the connections in a building structure are subjected to combined uplift and horizontal loads

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under wind action. In general, poor structural performance of residential building (Yancey et al., 1998) occurs due to incomplete uplift and/or horizontal load paths. Practices that lead to lack of such integrity include insufficient or poorly detailed inter-component connections (e.g. roof-to-wall connections, wall-to-wall connections, wall-to-floor connections, as well as connections between roof or wall members, etc). The Wall of Wind will provide a realistic environment to investigate connection performances and develop innovative new connection systems.

4.4 Development of Techniques to Minimize Water Infiltration

Rainwater intrusion into buildings causes significant damage to the interior and contents. While many coastal homes still survived past hurricanes structurally, they received enough rainwater penetration to require massive interior restoration and occupant displacement until completion of repairs. The Wall of Wind, which can simulate hurricane wind and driven rain acting on real component products with full-scale Reynolds and Froude numbers as well as other parameters governing aero-hydrodynamic similarity, is a much improved tool for investigating the phenomenon and developing new products and designs to reduce water damage from future hurricanes. This may include, for example, perfecting the design of the so-called rain-screen system, or developing less expensive equivalents for residential applications. Another example in this area is for the Wall of Wind to assist in developing soffit systems with improved wind/rain resistance to prevent wind-driven rain from entering buildings through the venting porosity underneath roof overhang, which is evidenced as a major cause of damage and loss in past hurricanes.

4.5 Research and Development to Reduce Debris Impact Damages

The potential of the Wall of Wind for research on wind-borne missile or flying debris will be explored. Such research would include the validation of computational trajectory models, the investigation of combined effects of wind pressure, driven rain and wind-borne debris, testing of product performance under these effects, and protocol development for canon-propelled debris and impact tests.

Impact resistant glass, laminated glass, shutters, advanced composite panels, and other products can be tested in the Wall of Wind for resistance to impact by wind-borne debris simulated by debris propelling devices, and for cycling pressure and rainwater infiltration resistances at and after impact. Successful utilization of the Wall of Wind in these areas will strengthen and rationalize building codes and product standards with respect to wind-borne debris impact and may play a positive role in updating and standardizing protocols for existing test methods (e.g. ASTM E1886/E1996, FBC§1626, and SBCCI SSTD 12).

4.6 Improvements in Building Codes and Product Standards

Accumulation of the Wall of Wind research findings will lead to better understanding of hurricane effects on structures, which is the basis for continued improvements in building codes and product standards, and thus for smarter buildings and stronger communities against hurricanes. Studies directed to specific building code provisions can also be devised if concerns arise.

5. Vision of IHRC to Build a Hurricane-Safe Coastal Community

According to prevalent forecasts, coastal states are in a cycle of heightened hurricane activity. Florida has been hit by eight hurricanes in 2004 and 2005, resulting in 2.9 million claims and $31.3 billion in insured losses. The possibility of a major hurricane striking a large population center in Florida during the next 20 to 30 years of high activity emerges as a near certainty. Regardless, the U.S. would continue to lose an average of $4 billion to tropical cyclone impacts and an additional $1.3 billion to other extreme wind events (C. Landsea, U.S. Congressional Testimony, 2004).

Post-disaster assessments following Hurricane Charley indicated that insured losses for structures built under the 2002 Florida Building Code (FBC) were as much as 40-50% lower than those built to the Standard Building Code (SBC). According to the preliminary estimates by the FIU Public Hurricane Loss Model (Powell et al., 2005), funded by the Florida Office of Insurance Regulation, the reduction in ground-up loss can be as much as 70%. Obviously, much more can and must be done to make the coastal community more resistant to hurricane impacts, reducing losses to homeowners, businesses, and the government.

Through partnerships with academia, federal and state government, and industry, IHRC intends to not only realize “Culture of Preparedness” through the creation of a more resilient coastal community but will also positively affect the commercial sector through new research and technological advancements.

The vision of the IHRC involves coupling academic research with societal impacts by building a vibrant program in hurricane damage mitigation through

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the development of the first-of-its kind facility for full-scale testing of low-rise buildings and structures. The mission is to lead the efforts in education, research, and commercialization of hurricane mitigation technologies that are essential to the economic health of the coastal states in the U.S. by:

- Conducting fundamental and applied research to gain better understanding of hurricane-induced wind/rain/debris effects on the built environment.
- Strategic alliances with industry leaders that will result in new inventive technologies, products, trades, and new ventures.
- Working with the industry partners to develop a streamlined research-to-market process with expeditious technology transfer and commercialization of technologies and products.
- Enhancement of building codes and product standards.
- Establish comprehensive workforce development programs, including new multidisciplinary curriculums, degrees, and certificates focusing on technology driven disaster mitigation.
- Enhancement of education and hurricane awareness at all levels in the community.

Acknowledgements

The Wall of Wind research is supported by the State of Florida, Florida Department of Emergency Management (FL DEM), RenaissanceRe Holdings Ltd. (RenaissanceRe), National Science Foundation (NSF), Applied Insurance Research (AIR) Worldwide, and others.

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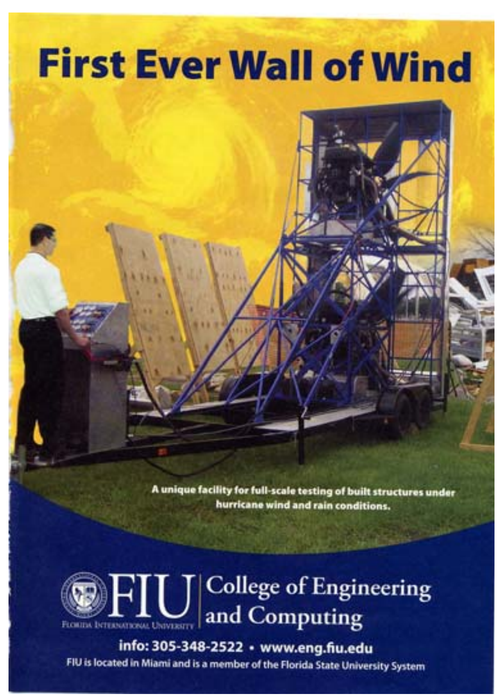


RWDI's Newest Branch in Florida

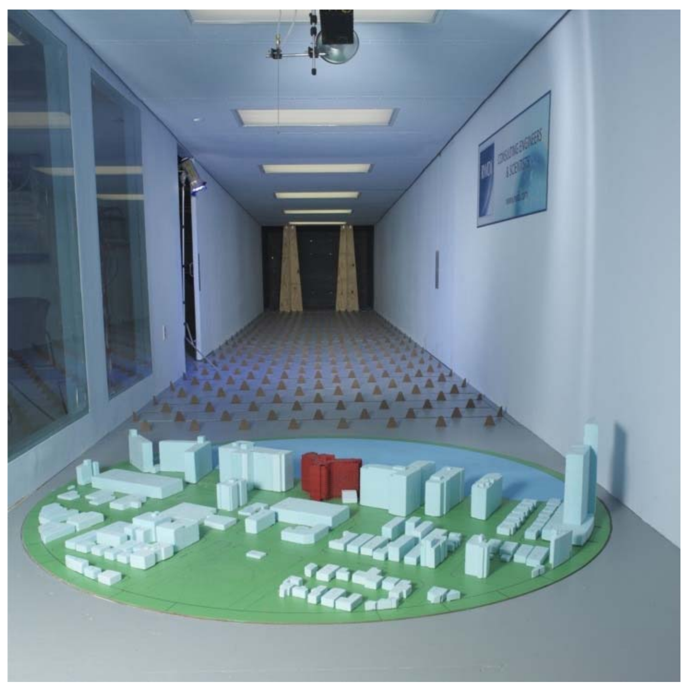
On 07 June 2007 Rowan Williams Davies & Irwin Inc (RWDI) cut the ribbon on its newest branch in Miramar, Florida. The announcement marks the opening of the company's first full-service wind engineering operation in the United States.

Florida General Manager and RWDI Principal, Frank Kriksic, said that "the new location sets RWDI up to serve a growing commercial development base in the Southeast United States, the Caribbean, Mexico, Central and South America. This year marks RWDI's 35th anniversary, and we are very excited to open this new Florida facility as part of our celebrations."

"Many of our top clients are from Florida and the long-range forecast for business development in the region is very good," said RWDI President, Peter Irwin, noting that the firm has completed more than 600 projects for clients in Florida over the past 15 years. "We felt it was long overdue for us to build a facility in the area to better serve our clients."

The Florida operation, located in Miramar near Miami, totals 10,000 square feet and will initially employ 15 people. The facility features a new boundary-layer wind tunnel and model-building shop, supported by engineers, technical and administrative staff. The Florida wind tunnel is the firm's fourth wind tunnel established to meet the needs of a growing client base. There are two wind tunnels at the company's head office in Guelph, Ontario, Canada and one at its United Kingdom operation, RWDI Anemos Limited in Dunstable, England.

Bob Swindell (Senior Vice President of The Broward Alliance), Gary Schumann (Enterprise Florida Director of International Business Development), Deborah Wilkinson (Global Business Development Manager), Gustavo Zambrano (Director of Economic Development & Revitalization), Frank Kriksic (Florida General Manager and RWDI Principal), Peter Irwin (President of RWDI), Marcy Grossman (Consul General, Consulate General of Canada) and Mike Soligo (Vice President and Principal of RWDI).



The 110-foot-long wind tunnel in Florida.

Air Quality Considerations when Designing a Residential or Office Building

By: Jeff Reifschneider, M.S.

Among the many responsibilities of a residential or office building developer, is to protect the health and welfare of building occupants. Indoor air quality is an important issue typically addressed by evaluating emission sources emanating from within the building. However, less emphasis is put on the important issue of the quality of outside air entering the building. Outside air can be contaminated with chemicals emitted from various exhaust sources on neighboring buildings. Examples of exhaust sources include: generators, gas combustion turbines, boilers, helicopters, and fume hoods.

Many factors determine whether or not a neighboring exhaust will be a problem. For example, the location of air intakes/exhausts, the distance between buildings, and the difference in height between the buildings.

The figures below demonstrate the impact of exhaust from a short building on a tall residential or office building.

As expected, the exhaust directly impacts the tall building when it is downwind. But less obvious, is the impact on the tall building when it is upwind. This phenomenon is caused by a building wake recirculation cavity created by the tall building. An initial screening to determine whether nearby buildings are within a tall building's wake recirculation cavity region can be performed by doing the following calculation by Wilson (1979):

$$R = B_s^{0.67} B_L^{0.33}$$

where B_s is the smaller of the tall building's upwind face dimensions of height or width and B_L is the larger of these dimensions.

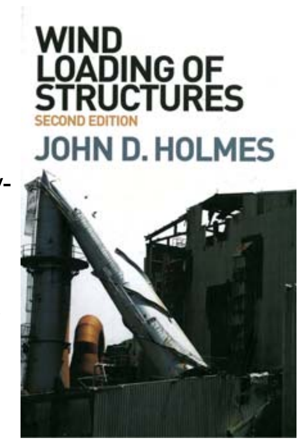
The value of R demonstrates how far a wake recirculation cavity extends from the tall building. If the initial screening approach shows that harmful exhaust sources are within the cavity, an advanced numerical or wind tunnel model should be considered to quantify exhaust impacts on the residential or office building. If adverse impacts are found, design modifications can be evaluated to mitigate the situation.

Jeff Reifschneider, M.S.
CPP, Inc.

Wilson, D.J. (1979), "Flow Patterns over Flat Roofed Buildings and Application to Exhaust Stack Design," *ASHRAE Transactions*, Vol.85, pp. 284-295.

Book Review of "Wind Loading of Structures – Second Edition" by John D. Holmes

Reviewed by Leighton Cochran



This second edition (2007) of Dr. Holmes book is published by Taylor and Francis and is a substantial expansion on the first edition published in 2001. Every chapter is updated with new or expanded information. The fundamental atmospheric physics are discussed first, and then the many topics associated with wind engineering and bluff-body aerodynamics are explored in logically broken-down chapters. This very readable text now has considerably more recent research on thunderstorms, tornadoes and downbursts than the first edition. There is a new section on modeling tornadoes in the laboratory and some interesting images and discussion of failures of lattice towers and a relatively new and important structural form – the wind turbine support tower. There is a much expanded chapter on wind loading standards used around the world, many of which have had new editions themselves since the first edition of this book. "Wind Loading of Structures" is a fine text for a wind engineering course and a useful reference for the practising wind engineer. There is a very interesting "world survey" of extreme wind climates in Appendix D that illustrates the varying wind regimes we have to deal with around the world. One of the final chapters discusses wind loading on a variety of odd structures that are designed by various specialty engineering teams: microwave dishes, rooftop solar panels, freestanding roofs and walls, awnings, parapets, rotating radar antennas and radio telescopes, as well as the ubiquitous mobile phone tower. I was hoping to see some discussion of wind loads on small tensile fabric roofs, as this industry is

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truly ignored in most codes around the world (AS/NZ1170 has some data on free hypar fabric roofs) and they are grasping for viable design pressures. Perhaps this will appear in the third edition? Anyway, "Wind Loading of Structures" by John Holmes is a must have for any wind engineer's library.

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President's Corner

In this issue we have some articles about two new wind engineering facilities in Florida, as well as some thoughts on the dispersion side of wind engineering. The Workshop Committee has been exploring venues for our inaugural AAWE Workshop meeting in the summer of 2008. Hopefully we will have more details on this event in the next issue. Thanks must go out to Graham Knapp of the British Wind Engineering Society for so prominently advertising our 11th Americas Conference on Wind Engineering (2009) in their September Newsletter. It is great to see this sort of exchange "across the Pond" – the IAWE would be pleased.

Dr. Peter Irwin of RWDI is to be congratulated on being awarded the Jack E. Cermak Medal by the American Society of Civil Engineers. This prestigious medal recognizes a lifetime of outstanding contributions to the research and practice of wind engineering. Congratulations Peter!

I would like to remind the membership to keep an eye on our web page, capably managed by Dr. Mike Gauss, www.aawe.org. Events and news of interest to the wind-engineering community are added quite regularly. An interesting recent addition is the video clip of light pole motion in strong wind. This is quite dramatic and will be the topic of an article in the next Newsletter. Of course for any webpage to be effective we must have text, pictures, videos etc passed on to the webmaster from the membership. Please feel free to contribute items of interest or announcements to Mike directly.

In the last Newsletter we thanked the people at High Velocity Inc. for purchasing a copy of the non-profit version of QuickBooks for AAWE. This Corporate Member of AAWE has now volunteered their in-house accountant to keep track of our financial records and membership using this software. Your dues and other financial transactions will all still go through myself and Dr. Steve Cai, but we now have the professional support of a trained accountant to help keep track of all things financial. This puts us on a more traditional-accounting, fiscal footing for our future growth. The AAWE Board and membership really appreciate this gift of professional time from Steve Camposano's company, High Velocity.

As many of you know, one of our more vocal members in recent years, Dr. Chris Letchford, has left Texas Tech University in Lubbock to lead the Engineering Department at the University of Tasmania in Hobart, Australia. We wish Chris the best of luck in this move, although it seems that being on an island has made him more prepared for ocean activities.

Chris seems ready for some snorkeling at the ICWE-12 in Cairns.

This newsletter continues to need articles from the members. Please send publishable items to me at lcochran@cppwind.com as Word files and image files for us to review and place in future editions. I would also ask the members to encourage others interested in wind engineering to join AAWE, either as individuals or as a corporation. Pass this newsletter on to them so they can use the rear pages to join (note that the membership calendar year of 2008 now applies).

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- The advancement of science and practice of wind engineering.
- The solution of national wind engineering problems through transfer of new knowledge into practice.

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Boundary Layer Wind Tunnel Laboratory, University of Western Ontario
www.blwtl.uwo.ca

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Wind Science and Engineering Research Center, Texas Tech University
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