



American Association
for Wind Engineering

THE WIND ENGINEER

NEWSLETTER OF AMERICAN ASSOCIATION FOR WIND ENGINEERING

Bogusz (Bo) Bienkiewicz, Editor

January 2003



TTU Wind Engineering Mobile Instrumented Tower Experiment - see story on p. 2

Natural Disasters of 2002 in the U.S.

(From FEMA Press Release, January 9, 2003)

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The Federal Emergency Management Agency (FEMA) reported that more than \$1.15 billion in disaster funds were expended in 2002 to help people and communities overwhelmed by disasters, which included earthquakes, floods, winter storms, fires, tornadoes, hurricanes and tropical storms. The expenditures were in response to 49 major disasters declared by President Bush involving 29 states and three U. S. territories in the Western Pacific. In addition, the agency authorized a near-record 70 fire management grants to help fight wildfires in 15 states, 11 of them in the western part of the nation that experienced one of the worst fire seasons in U.S. history.

FEMA funding obligated at year-end showed the costliest 2002 disaster recoveries included: the January ice storms that crippled Kansas, Missouri, and Oklahoma (\$241.5 million); Hurricane Lili, which struck Louisiana in early October (\$158.8 million); and Typhoons Chata'an and Pongsona, which devastated Guam in July and December, (\$119.6 million).

Among other major events that FEMA responded to in 2002 were:

- Floods - Spring and summer floods struck Kentucky, Tennessee and Virginia in March; Alaska, Indiana, Michigan and West Virginia in April and May; and Iowa, Minnesota, Montana, Vermont, Texas and

Wisconsin in June and July;

- Wildfires - The massive Hayman fire in Colorado and the Rodeo-Chediski fire in Arizona resulted in major disasters being declared in June for wildfires in those two states;
- Tropical Weather - The U.S. Gulf Coast was lashed with Tropical Storm Isidore in September and Hurricane Lili in October, which led to major disaster declarations for Alabama, Louisiana and Mississippi;
- Tornadoes - A swarm of Veterans Day tornadoes ravaged parts of Alabama, Mississippi, Ohio and Tennessee; and
- Winter Weather - An early December ice storm paralyzed North Carolina, causing extensive public property damage and prolonged power outages.

Statistically, Alaska and Texas led the nation in the need for federal aid, with each state requiring three major disaster declarations. Alabama, Guam, Indiana, Kentucky, Louisiana, Micronesia, Mississippi, Missouri, New York, the Northern Mariana Islands, Tennessee, Virginia and Wisconsin each required two.

A Student's Perspective on Placing Instruments in Hurricane Lili

J. Rob Howard

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Background

The Texas Tech University (TTU) Wind Science and Engineering Research Center (WISE) has established a program to collect and analyze high-resolution wind and other meteorological data from landfalling hurricanes. I have been fortunate to participate in WISE's Wind Engineering Mobile Instrumented Tower Experiment (WEMITE) program since its inception in 1998. My background includes a B.S. degree with majors in both physics and mathematics from Southeastern Louisiana University and a M.S. degree in mathematics from Texas Tech University, attained before joining WISE in 1997. In 1999-2000, I was asked to become the field leader of the WEMITE project, with the graduation of Dr. John Schroeder, the project's founder, and I now manage the project in cooperation with Dr. Schroeder, who recently became a TTU professor. Growing up in a hurricane

strike zone, the Mississippi River Delta in extreme southeast LA, programs devoted to understanding and mitigating hurricane impacts have always been of natural interest to me. The WEMITE project and others like it, such as those conducted by Clemson University and the University of Florida (CU/UF), are contributing to the knowledge base related to hurricane surface wind, and its structural transition and impacts at landfall.

The WEMITE program has continually expanded throughout its five-year existence, while collecting data in fourteen Atlantic tropical cyclones: Charley, Bonnie, Earl, Georges (1998); Bret, Dennis, Floyd (1999); Gordon (2000); Gabrielle and Michelle (2001); Edouard, Fay, Isidore, and Lili (2002). An example of some of the collected data using one of the towers is given in Figure 1. In 2002, the program's capabilities increased with the inclusion of a portable Doppler radar, the Shared Mobile Atmospheric Research and Teaching (SMART) radar (SR1), and it was appropriately renamed the Hurricane Surface Wind Instrumentation and Radar at Landfall (HSWIRL) project. In Lili, six towers instrumented with propeller-vane anemometry at various heights up to 15.2 m AGL, including one tower (WEMITE 2) instrumented at five levels, were deployed by a team of TTU students and

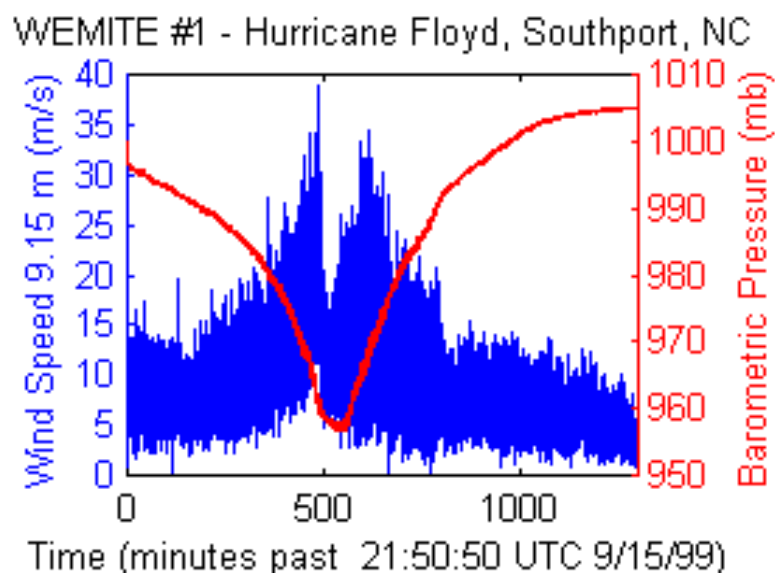


Figure 1. Wind speed and barometric pressure time series, Hurricane Floyd, 1999

faculty in strategic locations near the expected landfall location. More information on the equipment can be obtained on our website, <http://www.atmo.ttu.edu>.

Forecasting, Coordination, and Deployments

One of the keys to success in deploying wind-measuring equipment in the path of hurricanes is an accurate forecast. The call to send a team out and to instruct the team members where they will be headed is a crucial decision that weights on the success of the deployment. More equipment requires a longer lead-time to ensure a successful deployment. Hurricanes are by no means steady-state systems, and intensity, direction, and size changes require constant monitoring of conditions by trained meteorologists. To that effect, students and faculty back at TTU provide forecasting support to those in the field and also monitor all bulletins issued by the National Hurricane Center. If all of the equipment is not deployed within a reasonable amount of time ahead of the system, team member safety could be jeopardized. Thus, forecasting is of vital importance. Since it is over 650 miles from Lubbock to the nearest coast and as much as 1700 miles to locations along the southeast Atlantic seaboard, the call to leave must be made several days in advance to allow the equipment to be in place when the time comes.

In many ways, travel to and from the storm location is more dangerous than working within the hurricane environment itself. I am proud to say that no one has been injured in the five years of the program's existence. One of the main reasons for the hurricane field program's success is the coordinated, planned team effort that goes into every deployment. This could not have been demonstrated any more clearly than in Hurricane Lili, where a team consisting of six students (including myself), one faculty member, and a radar technician, left for Louisiana two days after several of us had just returned from collecting data in Tropical Storm Isidore in LA and MS.

Lili's track was well forecasted before our departure. However, the intensity forecast was problematic in that conditions appeared favorable for rapid deepening and the possibility of a major hurricane landfall over the less than accessible area of southwest LA. The team traveled to Crowley, LA in preparation for a LA landfall. Along the way, a portion of the team had to deal with repairing one of our trucks that had broken down while pulling a trailer carrying several of our towers. Six of our towers, a mobile mesonet (car instrumented with similar sensors to the towers), and SR1 made it to southwest LA for the landfall. With Lili bearing down on the LA coast, there was only one day to scout out deployment locations, obtain permission

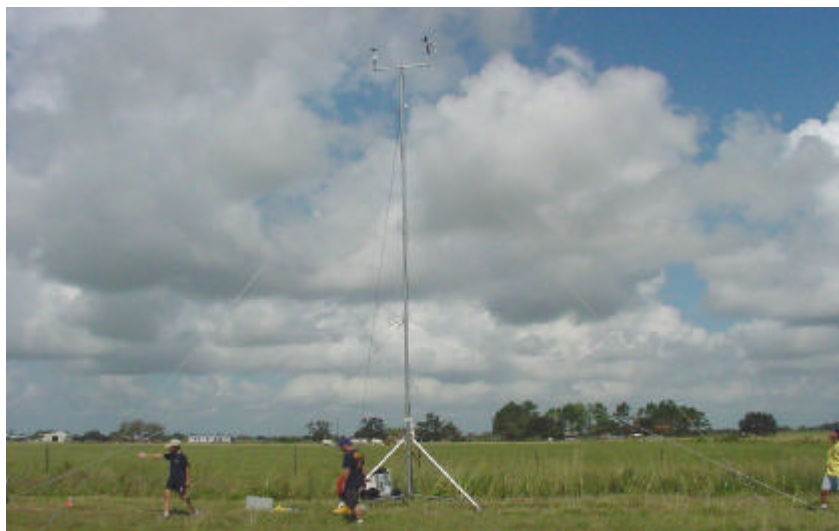


Figure 2. (Left to right) Atmospheric science graduate students Maribel Martinez and Caleb Midgely, and professor John Schroeder dismantling a 10-m tower after Hurricane Lili

to set up, and deploy all of the equipment.

The tower team broke into two groups, with one setting up two towers near Cow Island (southwest of Kaplan) (Figure 2), while the other group (including myself) headed towards the salt domes in hopes of finding a deployment location as close to the coastline as possible in suitable exposure, but not in an area susceptible to the expected 15-20 foot surge associated with the now Category 4 Hurricane Lili. I contacted the manager of the North American Salt Company mine on Cote Blanche Island, whom I had spoken with previously in Isidore about possibly locating some of our equipment there. After getting approval to deploy on the island, we crossed the ferry on the Intracoastal Waterway (providing the only automobile access to the island) and were given two-to-three hours to deploy our equipment before everyone had to vacate the island. With the help of the salt mine manager and the ferry operator, our small team set up WEMITE 2 on the southwest part of the island facing Cote Blanche Bay, approximately 30 feet ASL, out of the storm surge zone. Later, we rejoined the rest of the team and set up towers at the Acadiana Regional Airport in New Iberia and the Harry T. Williams Airport in Patterson.

Throughout this eventful day, I also helped to coordinate the placement of SR1 in Lafayette, and assisted the CU/UF tower team and the University of Oklahoma Doppler on Wheels teams by suggesting locations where they could place their equipment. Once all of our deployment tasks were administered, we retreated to a hotel in Lafayette, where the hotel operators were only able to give us a room for one night. During the nights after Lili struck, finding a hotel became an adventure as power companies had previously reserved almost every room along the LA coast in anticipation of work in Lili's aftermath.

As Lili made landfall over Marsh Island on the western edge of Vermillion Bay, John Schroeder, Caleb Midgely, and I traveled along Highway 90 near New Iberia in the mobile mesonet vehicle collecting data from the right-semicircle of the hurricane. Later, we made an attempt to reach Interstate 10 in hopes of heading towards Crowley, where several Lili-spawned tornadoes had been reported. We ended up watching the remainder of

Lili from a very open parking lot since collapsing power lines had made it too dangerous to travel. All of the towers with the exception of WEMITE 2 at Cote Blanche were dismantled and site characterizations conducted within the next day, with all personnel but Caleb and I returning to Lubbock. We remained to see if we could gain access to the island, which was surrounded by storm surge waters for several days after Lili's departure from the region. The next day, Caleb departed for Lubbock due to obligations requiring his presence and I remained to retrieve WEMITE 2. After staying with my parents for two days in lieu of hotel accommodations, my dad and I retrieved WEMITE 2 from the island, intact and having collected valuable data. We noticed that a black bear had tracked around the tower sometime while it was set up on Cote Blanche. Stories from 2002 of team members fighting off fire ants, swarms of mosquitoes, and snakes to set up the equipment will resonate for years to come.

This field data collection program would not be a success without the support of students (both undergraduate and graduate), staff, and professors from multiple disciplines at TTU and coordination with other institutions and government agencies (thanks to NOAA/AOML Hurricane Research Division!). It has been an honor and a privilege to be part of such a worthwhile program with potential far-reaching positive impacts on hurricane wind damage mitigation.

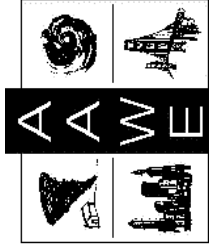
President Signs NSF Bill

President Bush on December 19th signed the National Science Foundation (NSF) reauthorization bill, H.R. 6446, also known as the NSF Doubling Bill. The bill approves a doubling of funding for NSF over the next 5 years. It authorizes \$5.5 billion for NSF for FY 2003, up from \$4.8 billion budgeted in FY 2002 and annual increases through FY 2007, when it would reach \$9.8 billion.

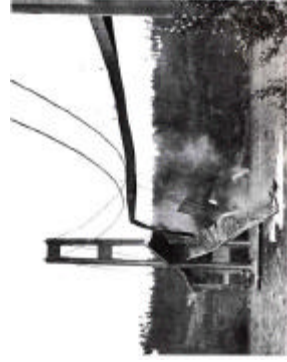
The new law includes a "tech talent" provision that would provide funds for training and programs to support increasing the number of math, science and engineering students.

(From This Week in Washington, ASCE, 12/20/02)

American Association for Wind Engineering



American Association
for Wind Engineering



**A Professional Organization
Dedicated to the Advancement of
the Science and Practice of Wind
Engineering and the Solution of
National Wind Engineering Problems**

Impact of Wind Hazards in the United States

Homes, Businesses, Schools, Hospitals, Nursing Homes, Day Care Centers, Family Security, Community Security – All in Danger. Windstorms in the United States, such as hurricanes, tornadoes, frontal winds and downbursts are currently causing unacceptably high levels of injuries, deaths and business interruption, property damage and other significant negative societal impacts. Unfortunately the level of losses is increasing each year and will continue to escalate unless knowledge and technology generation, education and public policies are improved.

It is estimated that as many as 33,000 homes were destroyed or made uninhabitable due to wind and water impacts from landfall of Hurricane Andrew in 1992. Each year thousands of homes are destroyed or made uninhabitable, personal possessions destroyed and numerous lives lost due to windstorms. Yet in spite of wind-induced damage, resulting in the largest percentage of insured property losses in the U.S., relatively little research is carried out to achieve dramatic improvements in this situation. Amazingly in spite of these severe impacts there have not yet been any direct measurements made of the actual extreme ground-level wind speeds reached or the spatial distribution in various types of extreme windstorms. Wind damage can affect many types of structures. The most vulnerable are low-rise buildings, such as residential units and small commercial and manufacturing buildings. Very limited investigations have been devoted to improve understanding of the behavior of such structures acting as a system. Such studies would require some form of full-scale testing configured for investigation of the sequence of failure mechanism. However, virtually no such studies have been carried out up to the present date. Another serious problem is the very large U.S. investment in existing constructed facilities that have inadequate lateral load resistance and pose a serious hazard. AAWE is dedicated to working

toward mitigation of the hazards posed by these problems.

Background

The American Association for Wind Engineering (AAWE) is a non-profit technical society formed to bring together civil engineers, meteorologists, architects, planners, public officials, social scientists, manufacturers, contractors, insurance industry and others, who are interested in mitigation of wind generated damages to buildings and other structures.

The AAWE was originally established as the Wind Engineering Research Council in 1966 to promote and disseminate technical information in the research community. In 1993 the name was changed to American Association for Wind Engineering and the AAWE was incorporated as a non-profit professional organization.

The multi-disciplinary field of wind engineering considers problems related to wind and associated water penetration on buildings and structures, societal impact of winds, hurricane and tornado risk assessment, cost-benefit analysis, codes and standards, dispersion of urban and industrial pollution, support for wind energy activities and urban aerodynamics.

Objectives of AAWE

- Promote the exchange of information among researchers and practitioners;
- Stimulate research efforts in wind engineering to build a knowledge base for wind hazard mitigation;
- Assess and prioritize leading-edge research in wind engineering;
- Provide advice to governmental agencies and other interested parties on wind research efforts and needs;
- Maintain communication with similar organizations in other countries and international organizations;

- Develop and execute plans for learning from future windstorms by gathering post-disaster data and analyzing and disseminating information.

Geographic Coverage

When first established, AAWWE (WERC) was primarily focused on wind engineering activities in the United States and Canada. In 1999 the International Association for Wind Engineering (IAWE) recommended that wind engineering activities be carried out on a broader basis and be organized into major geographic regions: Europe-Africa, the Americas-Caribbean, and Asia-Pacific. Each of these regions currently holds regional conferences on a four-year cycle.

AAWWE is striving to serve the Americas-Caribbean region.

Past Activities of AAWWE

AAWWE has carried out an expanding scope of activities addressing the AAWWE objectives. They included: the sponsorship of a series of wind engineering conferences, publication of a bimonthly newsletter, operation of a web site (that provides information to the profession and the public), publication of special documents, organization of special workshops (to define research needs and opportunities in wind engineering), and representation of wind engineering community (research and technology transfer needs and opportunities) to governmental organizations and professional organizations.

The first national conference held under AAWWE (WERC) sponsorship took place at the California Institute of Technology in 1970. Since then there have been 8 additional conferences: seven U.S. National Conference on Wind Engineering and one (the most recent, in 2001) conference entitled "Americas Conference on Wind Engineering". The next conference – the 10th Americas Conference on Wind Engineering is to be held at Louisiana State University in June of

2005.

AAWWE actively participates in activities of IAWE. One of contributions of AAWWE in this area is co-sponsorship of the International Conference on Wind Engineering (ICWE). The next ICWE is to be held in Lubbock Texas on June 2-6, 2003. Information is available on the web site www.icwe.ttu.edu.

Future Activities of AAWWE

AAWWE will continue its program of activities that have been carried on in the past and including the organization of national and international conferences, and will strive to expand its program of making information available to the wind engineering community. It is planned to compile such information on CD-ROMS and through special publications. The members of AAWWE are encouraged to participate in activities of AAWWE committees and other initiatives of AAWWE. Such participation is invaluable in development of an AAWWE action plan focused on identification of research and practice needs to improve safety of buildings and structures and to maximize wind hazard mitigation.

Benefits of AAWWE Membership

AAWWE has operated on a primarily volunteer basis and has kept expenses low. However, there are expenses in preparing and publishing the AAWWE newsletter, maintaining the web site and in striving to maintain communication between the wind engineering community and governmental and other organizations. Becoming a member of AAWWE accomplishes the following objectives:

- Provides identity for the field of wind engineering and the need to advance the science and practice in this area;
- Identifies you as a professional with interest in the wind engineering field and provides you with specialized information;
- Provides a defined avenue to make new

- wind engineering knowledge available; Contribute to the saving of lives and reduction of damages due to extreme winds.

AAWWE Dues (Jan. 1 – Dec. 31)

Individual Member \$50
 Student Member \$10
 Corporate Member \$500 or more (includes 5 individual members)

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**American Association
for Wind Engineering**

Membership Application/Renewal Membership Year: 1 January - 31 December 2003

Dues (Check appropriate category):

Individual Membership: \$50____, Student \$10 _____

Corporate Membership; \$500 or more: ____ . Corporate membership can include up to five individual members. Complete one form for each individual member.

Please make checks or other payments (in U.S. \$ equivalents only) payable to American Association for Wind Engineering and mail to:

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**American Association
for Wind Engineering**

OBJECTIVES

The American Association for Wind Engineering (AAWE) was established in 1966. The objectives of AAWE are: (1) the advancement of the science and practice of wind engineering and (2) the solution of national wind engineering problems through transfer of new knowledge into practice.

CURRENT OFFICERS

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WHY YOU SHOULD JOIN:

AAWE provides networking opportunity with U.S. wind engineering community through regular and special publications, e-mail communication, internet resources, and technical meetings.

HOW TO JOIN

Fill-in the Membership Application/Renewal Form and forward it to AAWE Secretary/Treasurer. For more information visit AAWE web site or contact Mike Gaus (mgaus@gaussassoc.com, 757-258-1273, voice) or Bo Bienkiewicz (bogusz@engr.colostate.edu, 970-491-8232, voice).

Get involved in formulating
National Wind Hazard Reduction Program

Please Post

WISE Researchers Find Answers in Disaster

(TTU Press Release, Lubbock, Texas, December 2002)

After the wake of damage caused by a family of tornadoes cutting a swath across the United States from Louisiana all the way through Pennsylvania on November 10-11, 2002, two teams of researchers sift through the wind-torn debris fields and document the damage. The information collected will help researchers at the Wind Science and Engineering Research Center at Texas Tech University understand what types of wind forces caused the damage and continue to evaluate construction and building codes to reduce the level of damage caused by future storms.

“Occupant protection is our primary concern,” said Dr. Ernst Kiesling, WISE researcher and Professor of Civil Engineering at Texas Tech University. “Homes and buildings have failed and will continue to fail. We want to focus on protecting the people inside the homes and reducing failure under heavy winds.” Although tornadoes caused most of the damage in recent storms, heavy winds also play a large role in damaging buildings and homes. According to experts at the WISE center, little can be done to protect homes and buildings from the damaging forces of a tornado. Storm shelters, above and below ground, provide the best protection from these types of storms.

Because the storms on November 10 and 11, 2002, covered such a large area, WISE researchers

divided forces to get a better picture of the damage before clean-up crews removed the debris fields. Larry Tanner, WISE researcher and lecturer at Texas Tech University, began his journey in Van Wert, Ohio. “Concrete blocks and other construction materials were found over half a mile from their original structures,” said Mr. Tanner. “In one movie theater, occupants sought refuge in a bathroom. Roofing materials above the room were blown off, exposing the occupants to potential injuries.

Investigators collected documentation for these storms in Ohio, Tennessee and Alabama. James Waller, president of the National Storm Shelter Association, assisted by collecting information in Tennessee, his home state. Supporting information from the National Weather Service helps researchers develop a complete understanding of the storms’ size and intensity. NWS data for Alabama indicated the storms’ size at over one-half mile wide, traveling a distance of almost 45 miles. A large amount of damage caused by the storm in Alabama occurred in the Carbon Hill area. “The Carbon Hill elementary school was damaged extensively. Had people been in the area, injury or death would surely have resulted,” said Kiesling.

The WISE center began collecting storm damage data in 1970. A list of the storms investigated can be found on their website at www.wind.ttu.edu. Information available from the WISE center also includes an archive of photos, descriptions of damage, and maps of the investigated storms. To obtain more information on the work conducted at the WISE center, visit their web site, or contact them by phone at (888) 946-3287.



Aftermath of destructive tornadoes

The Role of Tie Downs for Manufactured Homes in Hazardous Winds

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Laramie, WY 82071*

Previous research aimed at mitigation of wind damage for manufactured homes has included application of air bag loading to simulate lateral loads, development of rational analysis techniques to evaluate the three-dimensional behavior of the structural systems involved, and efforts to evaluate wind loads using wind tunnel modeling. While each of these efforts has been useful in its own right, there has not been a fully-integrated effort to combine wind loading research through appropriate wind tunnel testing and full-scale field tests in a high wind environment. Recent research conducted under the sponsorship of the PATH Program through NSF builds on previous studies by addressing determination of wind loading on manufactured homes through an integrated laboratory and field study. Researchers from University of Wyoming (UWYO) and the Idaho National Engineering and Environmental Laboratory (INEEL) have collaborated in research on durability of manufactured homes, funded by NSF, Department of Housing and Urban Development (HUD) and the Manufactured Housing Institute (MHI). Assistance was also given in wind tunnel testing by Colorado State University.



Figure 1. Manufactured home tested at field site near Arlington, WY

Results of wind tunnel testing and ASCE-7 wind load predications, along with assessment of the per-

formance of a single-wide manufactured home (see Figure 1) subjected to the natural high wind environment for more than two years are currently being finalized in a final report. Only minor roofing damage was noted for the manufactured home in spite of wind velocities exceeding 80 miles per hour. Measured tie down forces (see Figure 2) demonstrated the need for appropriate anchoring of the tested home. The fact that the structural system of the home performed without any measurable damage under high wind loads (and previously in air bag lateral load tests to 30 psf) can be, at least in part, traced to fact that the tie down system provided needed resistance against any substantial lateral movements which could have resulted in structural damage. Thus, based on the performance of the tested structure, it seems imperative that adequate tie down systems be installed, particularly in areas of expected high winds to insure that the full strength of the manufactured home's box-like structural system be enabled to resist high lateral loads.



Figure 2. Tie down system and force transducers

Profile of Dr. Ahsan Kareem - Recipient of the J. E. Cermak Wind Engineering Medal

As we reported in the past issue (November 2002) of *The Wind Engineer*, Dr. A. Kareem, Prof. at the University of Notre Dame and Past President of AAWE is the first recipient of the Jack E. Cermak Medal. This award was established by the Engineering Mechanics Division and Structural Engineering Institute of ASCE to recognize outstanding achievements in

the field of wind engineering and industrial aerodynamics.

Ahsan Kareem, Robert M. Moran Professor of Engineering, joined Notre Dame in 1990 following his tenure at the University of Houston, where he had been serving as Professor and Director of the Structural Aerodynamics and Ocean Systems Modeling Laboratory. Ahsan received his bachelor's degree with distinction from Pakistan University of Science and Technology, followed by a Master's degree from the University of Hawaii through a joint program at MIT under the Fullbright Program and his doctorate from Colorado State University.

Ahsan's research interests cover a wide spectrum of topics in Civil Engineering, with his primary work focusing on probabilistic structural dynamics, fluid-structure interactions, risk assessment and structural safety, and particularly the mitigation of natural hazards—specifically wind, waves and earthquakes. Through the use of computer models coupled with laboratory and full-scale experiments, he focuses on better understanding the impact of natural hazards on the built environment and developing effective mitigative strategies to enhance the performance and safety of structures under service and extreme loads.

His work has made significant contributions to the existing literature, with more than 135 articles in refereed journals and over 60 in other refereed/reviewed publications. These research efforts have been further distinguished by numerous honors, including one of the first Presidential Young Investigator Awards from the White House Office of Science and Technology in 1984; co-recipient, 1997 Engineering Award from the National Hurricane Conference; 1998 Distinguished Alumnus of Colorado State University; 1999 Munro Prize for the best paper in *Engineering Structures*, Elsevier.

Ahsan is active in a number of organizations and editorial boards, serving as Chair of the Engineering Mechanics Division of ASCE, Editor-in-Chief for an international journal, *Wind and Structures*, past associate editor for the *Journal of Engineering Mechanics* and the *Journal of Structural Engineering*, guest editor of the *Journal of Wind Engineering and Industrial Aerodynamics and Structural Safety* and member editorial board of five interna-

tional journals by Elsevier.

President's Corner

Well here we are in a new year and in looking back at the last year there is good news and bad news. The good news is that 2003 was a year that did not see any "Hurricane Andrew-type" impacts although there was substantial loss and destruction due to tornadoes and other extreme wind events. Some other good news was an increase in recognition for the need to better understand the resistance aspects of buildings as well as the loadings. The meeting on Full-Scale Testing held in Toronto in Dec. 2002 focused attention on this issue and will be reported in a future Newsletter. Hopefully we will be as lucky this next year in avoiding severe impacts but it is certain that this is a losing game and eventually we will pay the price.

The bad news is that the Wind Hazard Reduction bill that had been introduced in the U.S. House of Representatives died in committee and did not go anywhere. In addition the support picture for wind engineering research has been marginal and the situation at universities and research centers continues to degenerate. Although there is a large gap regarding how much resistance structures should be required to present for wind resistance and how much ductility could be developed in failures, progress on answering such questions will not be well resolved with the present level of activity. There is also a serious problem in the human resources side of wind engineering. With the current situation, not many students and faculty are willing to tie their careers to such a poorly supported field and the future supply of professionals with specialized wind engineering research and design capabilities will be low.

We need to hone our communication talents and do a better job in convincing the public that an increased investment in improving wind engineering knowledge will deliver very impressive future returns in reducing future impacts of extreme winds and water penetration. Your help in working toward these goals is needed particularly in supporting the introduction of another Wind Hazards Mitigation bill.

AMERICAN ASSOCIATION FOR WIND ENGINEERING
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Established in 1966

Objectives:

- 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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www.cppwind.com

Factory Mutual Engineering and Research Group
www.factorymutual.com

Lockheed Martin Technologies Co.
www.lmco.com

Rowan Davies Williams & Irwin Inc.
www.rwdi.com

Wind Engineering and Fluids Laboratory, Colorado State Univ.
www.windlab.colostate.edu

Wind Engineering Research Center, Texas Tech Univ.
www.wind.ttu.edu

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