

# The Wind Engineer



American Association  
for Wind Engineering

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Spring 1996

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## CONFERENCE ON NATURAL DISASTER REDUCTION

The ASCE International Conference and Exposition on Natural Disaster Reduction was held in Washington, DC on December 3-5, 1996. AAWE was among the cooperating organizations, which included forty-eight other national and international organizations, institutes and associations. The conference was co-chaired by Dr. Paul C. Jennings, Cal Tech, George Hausner, Cal Tech, and Riley Chung, NIST. AAWE President Ahsan Kareem served as a member of the Conference Advisory Committee.

The three-day conference included plenary sessions, a keynote luncheon, exhibits and eight concurrent technical sessions. The conference was attended by more than 350 people from the USA and around the world.

### Objective of Conference

The objective of the conference was to promote and assess the role of civil engineering, through interaction with other engineering disciplines and sciences, in preventing, mitigating, preparing for, and recovering from natural disaster impacts on the built and natural environment. Natural disasters include: earthquakes, volcanoes, hurricanes, tornadoes, hail, floods, tsunamis and land slides.

A resolution was approved by the conference participants that called for each country to reduce the damage resulting from natural disasters by developing appropriate programs of research, education and application.

The resolution advanced the idea that international collaboration should be strengthened by use of unique facilities, exchange of personnel and data bases, and that each country should immediately initiate disaster reduction policies and practices and implement them. The resolution is to be distributed to the United Nations, Heads of Governments, the

National Committee of IDNDR, government agencies, professional societies and the news media.

### Technical Program

Eight concurrent sessions were scheduled for the technical program. Session topics included: Hazard Identification, Vulnerability Assessment, Risk Management, Mitigation, Institutional Issues, Education, Recent Disasters, and Response and Recovery. A Proceedings volume was published that contains two-page abstracts of each technical presentation. Copies of the Proceedings are available from ASCE.

### Speakers

Welcoming remarks were delivered by Edward Groff, President of ASCE. He said, "Hazard mitigation is the key to reducing long term risks to natural hazards. Dollars spent on mitigation produce returns in reduced suffering and property destruction. Mitigation strategies should be multihazard, interdisciplinary and long term." *(Continued on following page)*



### LATE BREAKING NEWS

AAWE President Ahsan Kareem announced recently that he was approached by several interested parties to conduct a workshop to explore the needs and suitability of a system for large scale testing under wind loads. He agreed to organize the workshop on behalf of AAWE under the sponsorship of NSF and NIST. Dr. Kareem made a point of stressing that the workshop is not intended to endorse any single concept, but rather AAWE will serve as a facilitator. No membership funds are involved, only the valuable time of our president.

People involved in large-scale testing, wind tunnel, and full-scale testing from both the US and abroad have been invited. Jack Cermak has agreed to chair the workshop. More information on this workshop will be available later as plans are finalized.

In the opening plenary session, Paul Jennings cited progress in risk reduction. Building codes and land use policy are slowly improving, and FEMA is beginning to invest in mitigation. Professor Jennings observed, "Research in natural hazards is of high quality." However, several problems still persist. Reducing earthquake damage to steel-framed structures has seen little progress, and the quality of wood-framed housing has proven to be an additional problem. The building stock in many instances is inadequate for resistance to natural hazards. Furthermore, research programs are underfunded and lack trained personnel. He concluded with four suggestions on what is needed in the future:

<b>Research:</b>	Generate new knowledge, educate more professional scientists and engineers, promote interdisciplinary research.
<b>Implementation:</b>	Develop better building codes and follow up with tighter enforcement. improve construction quality.
<b>Economics:</b>	Private sector must take the initiative on natural hazards reduction, but government assistance is needed.
<b>Education:</b>	Needed for both the general public and the decision makers.

Kerri-Ann Jones, Acting Associate Director, Office of Science and Technology Policy, presented a national point of view. The lead US Government agencies for natural hazard mitigation are FEMA, USGS, NOAA, NIST and NSF. The National Science and Technology Council (NSTC) ensures coordination across these agencies. A Science and Technology Natural Disaster Reduction plan has been developed. The key strategy is a shift from *reaction* to a natural hazard to *anticipation* of the hazard. This approach involves early planning rather than retrofit. In the foreign policy arena, natural hazard reduction policies relate to political stability and national security. An example of this is the cooperation between US and Filipino experts in the wake of the Mt. Penitubo eruption in the Philippines. Natural disasters today affect more than just the community directly involved. Disaster costs are increasing, and federal budgets are constrained. Yet, investments in mitigation can have seven-fold returns according to a World Bank study.

William Hook, chairman, NSC/CENR/SNDR, presented one of the most dynamic speeches. He showed loss statistics

by decade. The trend is increasing. Average losses for the first six years of the 1990's range from \$11 billion to \$25 billion per year. These figures suggest our approach to natural disasters is not working. Natural disaster extremes are inevitable, and communities cannot respond on their own.

Natural disasters divert billions of dollars from economic development and environmental protection to recovery after a disaster. The costs come off the top of our investments for the future in education, research, health, productivity, etc. National disasters are also a national security risk by affecting other countries around the world.

**A plan for natural hazard reduction should have three strategies: risk assessment, mitigation strategy and improved warnings.**

Risk assessment means improved hazard identification and assessment of the risks. Mitigation requires applied research, technology transfer, public awareness, incentives and leadership. Modernization of the National Weather Service meets the needs of improved warnings. We need a set of paradigm shifts from reaction to disasters to anticipation of hazards; from a fragmented, piecemeal approach to a comprehensive, end-to-end approach; from after-the-fact retrofits to building resilience from the start; from a focus on saving lives through structural integrity to a focus on uninterrupted functionality; from a focus on individual structures to a focus on urban, regional lifelines; and finally, from government bailouts to partnerships and individual responsibility.

## The Wind Engineer

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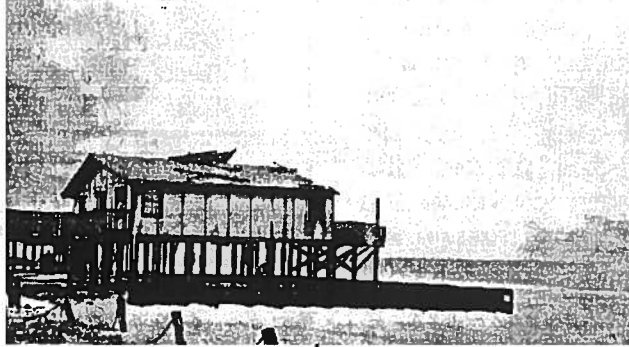
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## WINDS OF DESTRUCTION ROCK THE NATION

### HURRICANE FRAN

On the evening of September 5, 1996, Hurricane Fran made landfall at the southeastern tip of North Carolina, with the eye passing over Cape Fear. With a diameter of 290 miles and top winds estimated at 115 mph (peak), Fran continued to move in a north-northwest direction at 17 mph. About four hours after making landfall, the eye fell apart and by 8:00 a.m. on September 6, the storm had weakened as it moved into Virginia. At that time it was downgraded to a tropical storm with maximum winds of 65 mph. The storm was rated a Category 3 on the Saffir-Simpson scale at landfall.

A number of beach towns in North Carolina were inundated by the storm surge that ranged from 12-20 ft. At least 22 people lost their lives. Most deaths occurred as a result of falling trees. Emergency management personnel estimated that 800 buildings were destroyed, 1800 had major



damage and 6800 had minor damage. Wind damage appeared to be minor, but damage from the storm surge was very heavy.

The Roofing Committee on Wind Issues (RICOWI) had a Wind Investigation Plan in place at the time Fran made landfall. Eight teams from the roofing industry, academia and other interested parties were poised for a field operation. However, the RICOWI steering committee determined that wind damage to roofs in the area was not sufficient to warrant a full-scale operation. One RICOWI member, Marty Obando, was able to get a ride on one of the FEMA helicopters and obtained video and aerial photos of the damage.

Texas Tech University sent a team to document damage on the ground. Clemson University made an aerial survey, but did not send a team to the field. Others known to have conducted surveys were Dale Perry (Texas A&M) and Tom Smith (NRCA).

### ARKANSAS TORNADOES

An outbreak of 10 to 12 tornadoes struck central Arkansas on the afternoon of March 1, 1997, as a massive storm system moved through the state. Arkadelphia was among the towns hit hardest by the storms. The twister leveled a 10 square block area of the town center. President Clinton made an appearance in Arkadelphia and declared a number of counties in Arkansas disaster areas.

A surprising number of deaths were reported despite the fact that the National Weather Service was able to give a 20-30 minute warning. The majority of those who lost their lives were mobile home occupants. A Texas Tech University storm research team (lead by Jim McDonald) observed that many of the units were not tied down; those that were had ground anchors that were too short for the



soil conditions; the over-the-top and frame tie fixtures did not hold the ties. Many people were forced to ride out the storm in their mobile homes because there were no shelters or other substantial buildings nearby.

The damage was devastating. Units rolled on top of each other, the steel undercarriages were crumpled and twisted into masses of steel. Other units totally disintegrated, producing an enormous amount of windborne debris. The Texas Tech team concluded that local or state governments should institute tie-down standards and enforce them. Commercial park operators should be required to provide occupant shelters. Educational programs are necessary to emphasize the importance of seeking a safe shelter when severe thunderstorm warnings are issued. Improved warning times by the NWS are of no value if the populous is uninformed about proper evacuation and shelter-seeking actions.



## UNIVERSITY BEAT

### TEXAS TECH UNIVERSITY

Current projects at TTU include; correlation of Doppler Radar images with potential wind damage, evaluation of existing buildings for wind resistance, an expert system for wind resistant design of single family dwellings and additional missile impact testing for "safe rooms" in hurricanes. Occupants would ride out a hurricane in a "safe room" rather than evacuate. The cooperative program with Colorado State University continues to perform basic research relating to wind effects on low-rise buildings.

### TEXAS A&M UNIVERSITY

Dale Perry recently presented a series of eight seminars on Wind Loads based on ASCE 7-95 wind load provisions.

### COLORADO STATE UNIVERSITY

Jack Cermak presented an invited lecture for the Middle Atlantic Region of the Construction Specifications Institute in Atlantic City, NJ this fall. His lecture was entitled, "Wind Tunnel Modeling of Wind Loads for the Construction Industry."

### CONCORDIA UNIVERSITY

Ted Stathopoulos and Pat Saathoff received a grant from the Quebec Institute for Research in Health and Safety in the Workplace to carry out full-scale and wind tunnel measurements of dispersion of pollutants around buildings and their potential reingestion into buildings. Research has also progressed in the computational evaluation of dispersion of pollutants in the building environment. A water flume is under development into the Building Aerodynamics Laboratory at Concordia. It will simulate snow dispersion and accumulation around buildings.

### CLEMSON UNIVERSITY

Clemson University has expanded its wind engineering facilities with the addition of a new building. Structural load

testing with BRERWOLF on roof panels, wall and roof connection testing and other activities related to resistance of components, cladding and connections for low-rise buildings will be housed in the new facility. The existing wind engineering building will be dedicated to the large boundary layer wind tunnel and the 1:20 scale model of the Wall-of-Wind concept. The Wall-of-Wind concept is being investigated for the proposed Wind Storm Test Facility at the Idaho National Engineering Laboratory. The major thrust of research at Clemson is development of new methods for improving the wind resistance of low-rise buildings as well as retrofit solutions for existing buildings.

### WHAT ARE THE THREE DEADLIEST AND COSTLIEST MAINLAND HURRICANES ON RECORD?

#### Deadliest:

1. Galveston, Texas, 1900, estimated 8000 dead, Category 4
2. Florida, Southeast of Lake Okeechobee, 1928, 1836 dead, Category 4
3. Florida Keys and South Texas, 1919, estimated 600 deaths, over 500 on ships at sea



#### Costliest (Adjusted to 1994 dollars):

1. Andrew in Florida and Louisiana, 1992, \$26.62 Billion, Category 4
2. Hugo in South Carolina, 1989, \$7.91 Billion, Category 4
3. Agnes in Florida and Northeast U.S., 1972, \$6.93 Billion, Category 1

#### \*Saffir-Simpson Scale

Source: Deadliest, Costliest and Most Intense United States Hurricanes of this Century, U.S. Department of Commerce, NOAA, Tropical Prediction Center, Miami, Florida, February 1996. Available from NTIS, Springfield, VA.

## CONFERENCES

**Second European & African Conference on Wind Engineering (2 EACWE)**  
**Genova, Italy**  
**June 22-26, 1997**

Scholars and practitioners from the European and African Region, as well as from other parts of the world, will gather to participate in a scientific and technical forum on Wind Engineering. Official language of conference is English.

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**Fourth Asia-Pacific Symposium on Wind Engineering (IVAPSOWE)**  
**Surfers Paradise**  
**Gold Coast, Australia**  
**July 14-16, 1997**

Papers on all aspects of wind engineering were invited, but especially in the areas of wind characteristics and climate, wind tunnel modeling, computational modeling, full-scale measurements, building aerodynamics, vibration and fatigue, disaster mitigation & insurance, building codes & regulations.

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**Eighth U.S. National Conference on Wind Engineering (8USNCWE)**  
**The Johns Hopkins University**  
**Baltimore, Maryland**  
**Eighth U.S. National Conference on Wind**  
**June 5-7, 1997**

Held every four years, the U.S. National Conference on Wind Engineering provides a major forum for the exchange of information and discussion of recent developments in and applications of wind engineering. The conference is sponsored by AAWE.

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**Fourth International Symposium on Roofing Technology**  
**National Bureau of Standards**  
**Gaithersburg, Maryland**  
**September 17-19, 1997**

Theme of the IVISRT will be "Challenges of the 21st Century."

**Contact:**

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 National Roofing Contractors Association  
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 (847) 299-1183

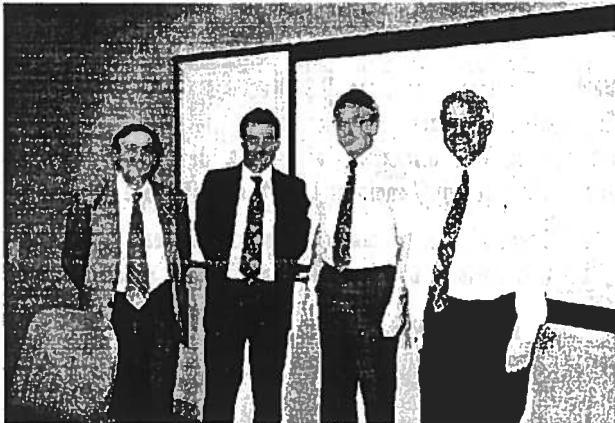


## NEW MEMBERS ELECTED TO THE AMERICAN ASSOCIATION FOR WIND ENGINEERING BOARD OF DIRECTORS

Dr. Nick Jones from The John Hopkins University and Dr. Peter Vickery of Applied Research Associates were elected to the AAWE Board of Directors, filling the positions left by departing members Dr. James McDonald and Dr. Tim Reinhold.

## ASCE WINDLOAD SUBCOMMITTEE

The ASCE 7 Windload Subcommittee will meet in Baltimore, Maryland on June 4, 1997 just prior to the Eighth U.S. National Conference on Wind Engineering. Chairman, Larry Griffis, requests all Subcommittee Chairs to be prepared to report on their work at the meeting. Any changes the Task Committee wishes to make in the next revision of ASCE 7 will need to be discussed at this meeting. Any changes must be finalized by October 1997 in order to be balloted by the Main ASCE 7 Committee in November.



Pictured to the left are the AAWE members of the ASCE 7 Windload Subcommittee, from left to right they are Ted Stathopoulos, Peter Vickery, Jon Peterka, and Larry Griffis

## Eighth U.S. National Conference on Wind Engineering

Held every four years, the U.S. National Conference on Wind Engineering provides a major forum for the exchange of information and discussion of recent developments in, and applications of, wind engineering. The Eight U.S. National Conference on Wind Engineering will be held at The John Hopkins University, the conference dates are June 5-7, 1997. The conference chairman is Dr. Nick Jones of The John Hopkins University.

The technical program for the conference comprises theme lectures, special lectures, and submitted papers on completed and ongoing research. The following are some of the representative topics that will be covered:

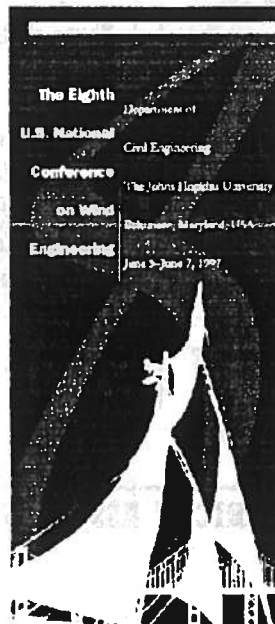
- Standards and Codes, Compliance and Public Policy
- Wind Forces on and Response of Tall Buildings
- Wind Loads on Cladding
- Wind Loads on Structural Systems
- Economic and Social Impacts of Extreme Wind Events
- Severe Wind Storm Damage Assessment, Analysis, and Mitigation
- Severe Wind Storm Wind Speeds

- Engineering Micrometeorology
- Numerical Simulation of Wind Flows and Wind Effects
- Dynamic Response of Structures (e.g., towers, chimneys, offshore platforms and cooling towers)

Keynote speakers include Joseph Golden, Emil Simiu, and Barry Vickery, in addition, Kishor C. Mehta, P.W. Horn Professor of Civil Engineering and Chairman of the Wind Load Task Committee, which produced three standards, ANSI A58.1-1982, ASCE 7-88 and ASCE 7-95, will present a special lecture entitled *ASCE 7-95 Standard: Consensus and Compromise*. This lecture will discuss the process of producing the standards and anecdotal incidences of significance over the past fifteen years of Dr. Mehta's experience.

The conference sessions will be conducted on the beautiful 140-acre Homewood campus of the Johns Hopkins University. The tranquillity of Homewood is just minutes away from downtown Baltimore and the attractions of the Inner Harbor, and less than an hour by train or car from Washington, D.C.

Additional conference information is available on the World Wide Web: <http://www.ce.jhu.edu/~8usncwe/index.html>



# ASK THE WIND ENGINEER

How do I determine effective wind area for obtaining ( $GC_p$ ) for components and cladding pressures in ASCE 7-95?

The effective wind area is used to determine ( $GC_p$ ) for components and cladding in Figures 6-5 through 6-8. At first glance the definition seems straight forward, but confusion can arise. Generally, effective wind area is the same as tributary area, i.e., the area contributing to wind load on a component. When the tributary area of a component is long and narrow, the effective wind area can be larger than the tributary area, because the gust size producing the pressure may not be long and narrow. To better approximate the actual gust size, the width of the effective wind area is taken as one-third the length. Thus,

Effective Area is  $L(L/3) = L^2/3$  where  $L$  is the length of the tributary area. The increase of effective wind area has the effect of reducing the average wind pressure acting on the tributary area. The effective wind area is only used to obtain ( $GC_p$ ) from the figures. The wind pressure should be applied over the actual tributary area for component design.

**Example:** What is the effective wind area for trusses that span 30 ft and are spaced at 2 ft on center?

**Answer:** The tributary area  $A_t = 30 \times 2 = 60 \text{ ft}^2$ . The effective wind area,  $A_w = 30 \times (30/3) = 300 \text{ ft}^2$

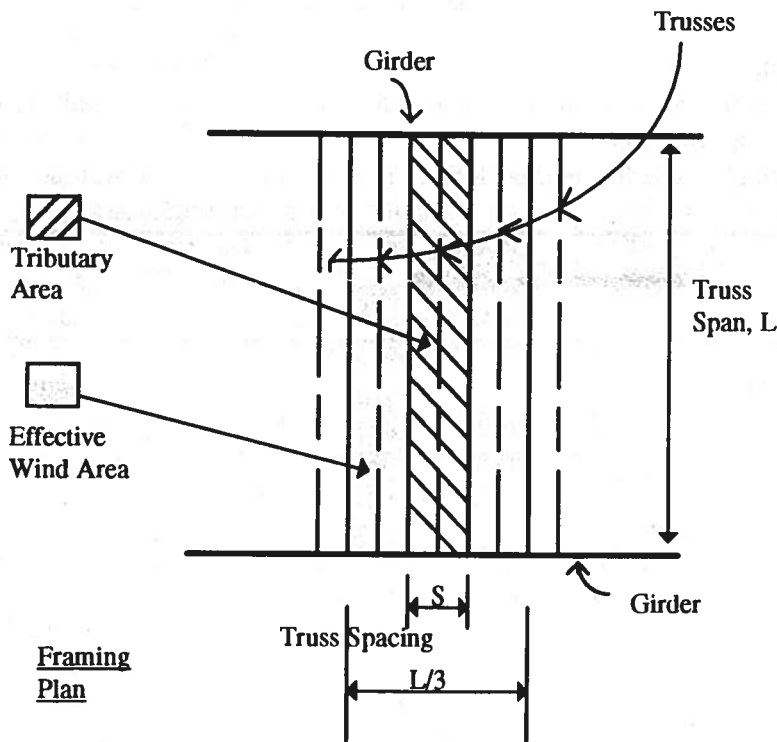
Use  $A_w$  to obtain ( $GC_p$ ).

**Example:** What is the effective wind area of an 8-ft high by 150 ft long concrete masonry wall?

**Answer:**  $A_w = 8 \times (8/3) = 21.3 \text{ ft}^2$  (This answer assumes the wall spans vertically between roof and foundation and that design is based on a one-foot wide section of the wall.)

**Example:** What is the effective wind area for design of studs on an 8-ft high wall with studs spaced at 16 in. on center?

**Answer:** Using the above approach;  
 $A_w = 8 \times (8/3) = 21.3 \text{ ft}^2$ .



$$\text{Tributary Area} = Ls$$

$$\text{Effective Area} = L(L/3) = L^2/3$$

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