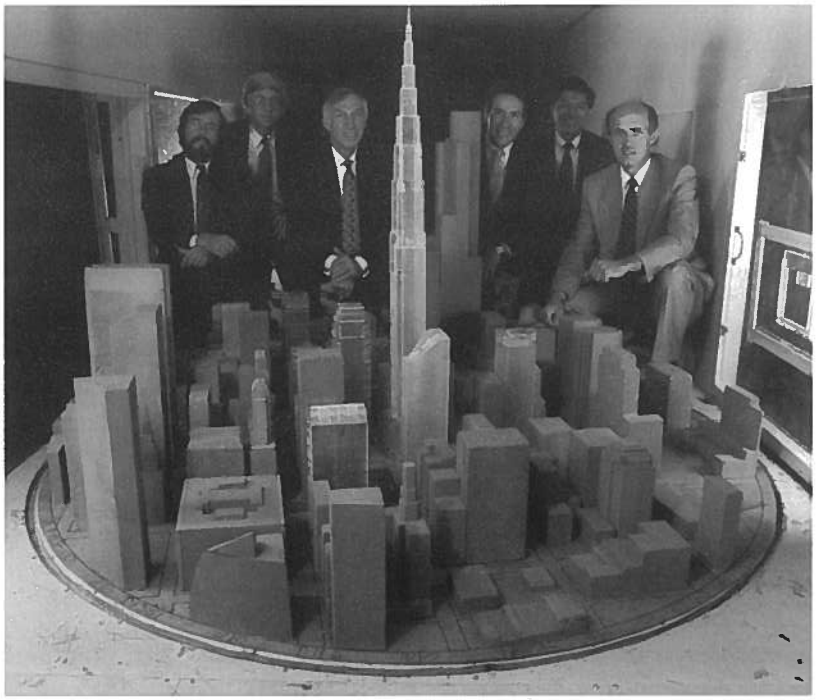
THE CHRONICLE OF THE WIND ENGINEERING RESEARCH COUNCIL

the Wind Engineer

Volume 5, No. 1 Fall, 1991

RWDI's Work on the Miglin-Beitler Tower, Chicago

The Miglin-Beitler building at 1999 ft. 11.5 in. will be the world's tallest building, surpassing the Sears Tower and the CN Tower, which rise to heights of 1454 ft. and 1822 ft., respectively. The slender building has a 141x141 ft. footprint at its base and tapers in a series of steps to its full height. The cruciform tube structure incorporates both steel and concrete in the composite construction. A concrete core with walls of varying thickness contributes significantly to the lateral stiffness of the building. Eight cast-in-place concrete fin columns are located at the faces of the building giving considerable stiffness with a relatively small footprint. Vierendeel trusses and floor beams carry the floor loads and provide additional resistance to lateral forces as well as improving the resistance of the entire structural system to torsion.



1:400 pressure model of Miglin-Beitler Tower in Rowan Williams Davies & Irwin's Boundary Layer Wind Tunnel in Guelph, Ontario. Visitors are: (from left) Gregg Jones of Cesar Pelli & Associates, Charles Thornton of Thornton-Tomasetti Structural Engineers, Lee Miglin and Paul Beitler, and Ray Chin of Miglin-Beitler and Dr. Peter Irwin, RWDI's Principal-in-Charge.

Both wind loading and wind-induced motion influence the design to a considerable extent. In addition the effect of the tower on the wind environment at ground level has become a concern.

Rowan, Williams, Davies and Irwin, Inc. (RWDI) in Guelph, Ontario has undertaken comprehensive wind tunnel tests on 1:400 scale models in its boundary layer wind tunnel. High frequency force-balance tests were conducted very early in the design so that overall wind loads and wind-induced motions could be evaluated. Initially the tests showed excessive motion, but after several iterations of increasing the mass and stiffness of the concrete structural system, Thornton-Tomasetti Engineers were successful in bringing down the motions to comfortable levels (i.e. within guidelines set by ISO). More recently aeroelastic model tests have been completed. These tests essentially confirmed the initial force-balance results, and, in addition, showed favorable effects of aerodynamic damping on the motions. Predicted accelerations at the top occupied floor are 23 milli-g on a 10-year return period basis.

A wind pressure study has been completed employing a rigid acrylic model instrumented with 1537 pressure taps. Peak 50-year wind suc-

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by Dale C. Perry

The two-day workshop held in July in Washington, D.C. proved to be a huge success. The five-year Strategic Plan approved in early 1990 was revisited in concert with oral and/or written reports from each of the Standing Committees. It was agreed that the focus of WERC for the next year should be on accomplishing the following objectives:

- *Increase the level of communication with the general membership.*
- *Establish the Wind Engineering Reference Library at Texas A & M as an important data base for those seeking information on wind engineering including journal articles, research reports, information on building codes, slide sets and videos on post-disaster studies, etc.*
- *Support and sponsor Conferences and Symposia.*
- *Establish a network for those seeking general information relating to wind engineering.*

Additionally, it was agreed that the format of the Wind Engineer *be changed. Twice-yearly a newsletter-type publication will be forwarded to the membership. A more extensive publication will be produced once per year (typically in July) containing short articles submitted by the membership, a review of ongoing research programs, white papers concerning issues of importance to the general public, and answers to questions submitted to the* Wind Engineer. *It is hoped that this new focus will provide more service to the membership and enhance the visibility of WERC.*

Washington, D.C. is Site of July Board of Directors Meeting

The Board of Directors met at the National Academy of Science, Georgetown Facility, in Washington, D.C. on July 16-17, 1991. Three officers and three board members made up a quorum for the meeting. Eight members and guests also attended.

Most of the first day was spent on standing committee reports. President Dale Perry presented a brief report for the chairman of the Full-Scale Data Depository and Technical Information and Archives Committee. Progress is being made on development of the Wind Engineering Reference Library (WERL) at Texas A & M University.

The Board took action to support the Jack E. Cermak Award sponsored by ASCE. The Board also voted to award a $1,000.00 scholarship to a wind engineering graduate student who is a member of WERC. The Awards Committee is charged with setting up the mechanism for awarding the scholarship. Leon Kempner reported that the 7th U.S. National Conference on Wind Engineering will be held at UCLA June 21-25, 1993 (tentative dates). Gary Hart will serve as conference chairman.

The Board made a significant effort to identify a comprehensive list of WERC membership benefits. Joe Colaco agreed to develop a summary of these benefits for distribution with new member solicitations.

The Board voted to reconstitute the Publications Committee and to appoint a new Editor of the *Wind Engineer.* The action called for the publication of two issues of the *Wind Engineer* per year and a *Wind Research and Applications Digest.* The latter publication should be more extensive in scope than the *Wind Engineer* with short articles and technical abstracts. Jim McDonald was appointed Editor of both publications. An Oversight Committee will act as a publication review board and will establish guidelines and procedures for WERC publications. The Board passed a motion of appreciation for the excellent work by Herb Saffir and the previous Publication Committee members.

A highlight of the meeting was a presentation by Mr. Michael R. Nelson of the U.S. Senate Committee on Commerce, Science and Transportation. He discussed a wide range of legislation that could affect the wind engineering community. President Perry spent a few minutes explaining the purpose of WERC to Mr. Nelson and offered the collective resources of the WERC membership to help stimulate progress in the wind engi eering area.

The Board reaffirmed a long-standing WERC policy of not supporting the travel of board or committee members to WERC meetings. The meeting adjourned with an expression of thanks for the hospitality of Riley Chung and the National Academy of Sciences.

TORNADO SYMPOSIUM III

Tornado Symposium III Honors Dr. T.T. Fujita

Tornado Symposium III was dedicated to the honor of Dr. T.T. Fujita, who is probably recognized today as the world's foremost expert on tornadoes. Born in Kitakyushu City, Japan, Dr. Fujita considers himself an observational meteorologist. He graduated from the Meiji College of Engineering in 1943. His advanced studies were conducted at Kyushu Institute of Technology.

Dr. Fujita joined the University of Chicago as a research associate in 1953. In 1956 he became Director of the Satellite and Mesometeorological project. He turned his attention to tornadoes in 1957 when he documented and analyzed the Fargo, North Dakota tornadoes of June 20, 1957. Since that time he has been at the forefront of technology, developing many theories and concepts from his observations in the field. The Fujita Scale, which is a means of estimating the intensity of tornadoes, was first published in 1971. The Fujita Scale is the accepted method for rating tornado intensity around the world today.

During the past two decades, Dr. Fujita devoted much of his efforts to the problem of downbursts. Originally associated with plane crashes at several airports, the downburst today is recognized as a weather phenomenon that also must be considered in developing wind load criteria for codes and standards.

In 1989, the University of Chicago named Dr. Fujita the Charles E. Merrimam Distinguished Service Professor. Over the years, he has received numerous honors, awards and medals recognizing his many contributions to science and technology.

The organizers of Tornado Symposium III named the symposium in honor of Dr. Fujita for his dedication to tornado research and his inspiration of a generation of graduate students and colleagues who have contributed greatly to the advances in understanding of tornadoes.

Tornado Symposium III was held in Norman, Oklahoma, April 2-5, 1991.The first tornado symposium since the one at Texas Tech University in 1976 was attended by more than 300 meteorologists and engineers. Twelve technical sessions were held on a variety of subjects, including tornado vortex theory and modeling, observations of tornado thunderstorms, tornado detection and warning, protection of important or critical facilities, climatology, hazards and risk assessment, damage surveys, damage mitigation and occupant safety, building codes and tornado forecasting.

One of the more interesting papers was presented by Burgess, Donaldson and Desrochers on Tornado Detection and Warning by Radar. The paper described the NOAA/NWS NEXRAD program which is scheduled to begin operations in 1993. NEXRAD is the new generation of Doppler radar that holds promise of giving much better tornado detection and warning.

Proceedings of the symposium are currently in press. Don Burgess, who is with the NWS/NEXRAD Operational Support Facility, said the *Proceedings* will be available in Spring 1992. For more information on the *Proceedings,* write to

Mr. Don Burgess
National Weather Service
NEXRAD Operational Support Facility
1200 Westheimer Drive
Norman, OK 73609
(405) 366-6510

From the Editor

As noted in the Minutes of the last WERC Board meeting, significant changes have been made in the arrangements for publishing *The Wind Engineer.* Two issues of *The Wind Engineer* each year will look about the same as before. The Board has authorized a third publication, to be called *The Wind Research and Applications Digest (WRAP Digest).* The latter document, although not intended to be a journal at this time, will carry more technical articles and abstracts.An Oversight Committee will act as a publication review board and will establish guidelines and procedures for WERC publications.

As Editor, I look forward to the challenge of producing WERC publications of superior quality and interest to the membership. Herb Saffir set very high standards, which I will try to maintain or exceed.

To have a successful newsletter and technical publication, I must rely on each of you to provide me with information that may be of interest to our readers. Initially, I would not ask you to write the story, but to simply suggest a topic or subject or event that would be of interest. Later, I might ask for assistance from you, if it would be more appropriate for you to make the written contribution.

Letters to the Editor, comments and suggestions will always be welcome.

Jim McDonald
Editor

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the Wind Engineer

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Miglin-Beitler Tower
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tions of up to 124 psf were identified at a few localized points on the exterior, with values generally ranging from 30 psf to 70 psf. These results will be used for curtainwall design.

The winds at pedestrian level in the adjacent streets (Madison, Wells and Franklin) were found to be remarkably little affected by the tower, despite its unusual height. Out of 42 locations where ground-level winds were measured on the model, only three were found to experience wind speed increases of more than 10%, whereas five experienced decreases of more than 10% and the remainder changed less than 10%. Tests with the 125-story tower replaced with a 50-story tower showed very similar results. These favorable findings were attributed to 1) the tower's stepped geometry which minimizes deflection of high-velocity winds downward, and 2) to its immediate surroundings which consist of numerous 30-, 40- and 50-story buildings that tend to provide a sheltering effect down at ground level due to the deep street canyons they form.

Design Architects for this project are Cesar Pelli & Associates, Inc., New Haven, CT. Charles H. Thornton, chairman and principal of the New York City-based consulting firm of Thornton-Tomasetti Engineers is the chief structural engineer. Peter Irwin is the principal in charge of the wind tunnel studies for RWDI.

Eighth International Conference on Wind Engineering Attracts Large Gathering

Approximately 325 delegates from 37 different countries gathered in London, Ontario, July 8-12, 1991 for the Eighth International Conference on Wind Engineering. The conference was hosted by the Boundary Layer Wind Tunnel Laboratory, University of Western Ontario. Alan G. Davenport served as International Conference Chairman.

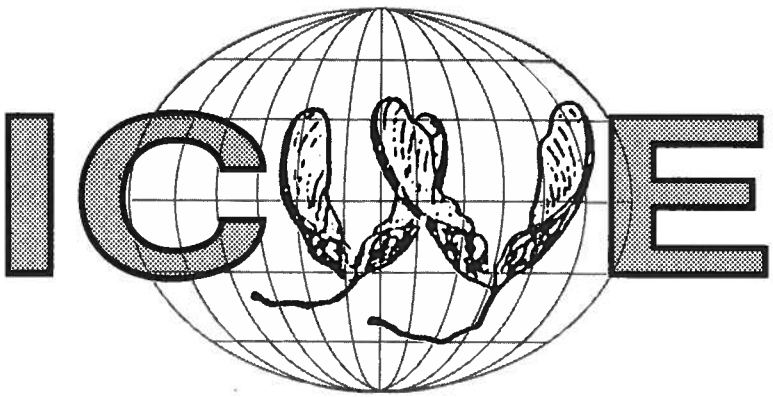
Each day of the conference began with a plenary session followed by three concurrent sessions dealing with a wide variety of topics in wind engineering. Two of the plenary sessions included the Martin Jensen and Kit Scruton Memorial Lectures. Both of these outstanding researchers have died since the last international conference. Five sessions each were held on the subjects of wind, bluff body dynamics and low buildings. Wind effects on bridges occupied four sessions while wind tunnel techniques, vibrations and pedestrian winds had two sessions. Single sessions were held on the subjects of wind and waves, ventilation, transportation, atmospheric dispersion, dispersion and drifting, computational fluid dynamics, and building codes. Including the plenary sessions, more than 243 papers were presented.

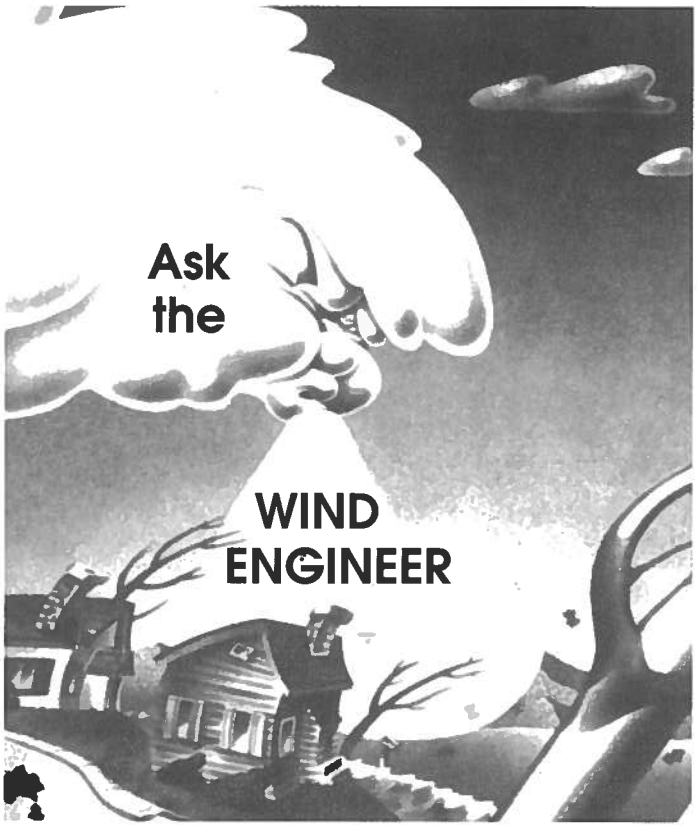
A post-conference tour to Toronto included a visit to the CN Tower, the Skydome (Home of the Toronto Blue Jays) and the laboratories of RWDI.

New Delhi, India was chosen as the site for the Ninth International Conference in 1995.

A preprint volume of two-page abstracts was distributed at the conference. The *Proceedings* volume will contain final papers that have been peer reviewed by two or more individuals. Abstracts will be used when final papers are not available. The *Proceedings* is expected to be available by summer 1992. Inquiries about availability should be directed to:

Boundary Layer Wind Tunnel Laboratory
University of Western Ontario
London, Canada
NGA 5B9





Design Wind Speeds for Tornadoes

Engineers sometimes are asked to design a structure to resist the effects of tornadoes. One question among many comes to mind: What should be the design wind speed? Model building codes are of little help, because they do not address tornado design. ASCE 7-88 has minimum guidance. A decision must first be made as to the acceptable level of risk. Many factors go into the decision, but keep in mind that someone must *make* the decision. Once the decision has been made, two source documents are available for guidance:

American Nuclear Society "*Standard for estimating tornado and extreme wind characteristics at nuclear power sites,*" ANSI/ ANS 2.3-1983 contains three maps that give tornado wind speeds for 1 x 10^{-5}, 1 x 10^{-6} and 1 x 10^{-7} annual probabilities. The maps were obtained by performing regionalization of tornado risks for the entire U.S. The DAPPL method of tornado hazard assessment developed by Dr. T.T. Fujita was used to develop the map. The wind speeds are considered to be peak gust winds. ANSI/ANS 2.3 - 1983 is a consensus standard.

The document "*Design and evaluation guidelines for Department of Energy Facilities subjected to natural phenomena hazards,*" UCRL-15910, was prepared for the Department of Energy (DOE) by a panel of experts and has received extensive public review and assessment. This document only gives recommended tornado design wind speeds at 26 DOE sites around the country. However, it recommends a design approach and suggests appropriate tornado missile criteria. The Uniform Approach to Wind Design recommends using the procedures in ASCE 7-88 to determine tornado wind loads on structures. Two factors must be taken into account: 1) tornado wind speeds must be expressed in terms of fastest-mile winds and 2) Exposure C is always used, regardless of the actual terrain roughness. The effects of atmospheric pressure change (APC) and missiles must also be taken into account.

Figure 3.2-3 from the ANSI/ANS 2.3 - 1983 is reproduced here to give an indication of the tornado design wind speeds for an annual probability of 1 x 10^{-5}. The wind speeds on the map are peak gust, not fastest-mile.

A formula, based on the Durst Curve, converts peak tornado wind gusts to fastest-mile in the range from 60 - 300 mph.

$$V_{fm} = 0.958V_t - 11.34$$

where
V_{fm} = fastest-mile wind speed
V_t = peak gust tornado wind speed

References:

ANSI/ANS, 1983: *Standard for estimating tornado and extreme wind characteristics at nuclear power sites*, ANSI/ANS 2.3-1983, American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525.

DOE, 1990: *Design and evaluation guidelines for DOE facilities subjected to natural phenomena hazards,* UCRL-15910, the Office of the Assistant Secretary for Environment, Safety & Health, U.S. Department of Energy, Washington, D .C. 20585.

We hope to make this column a regular feature of *The Wind Engineer,* so send your questions of general interest to the Editor.

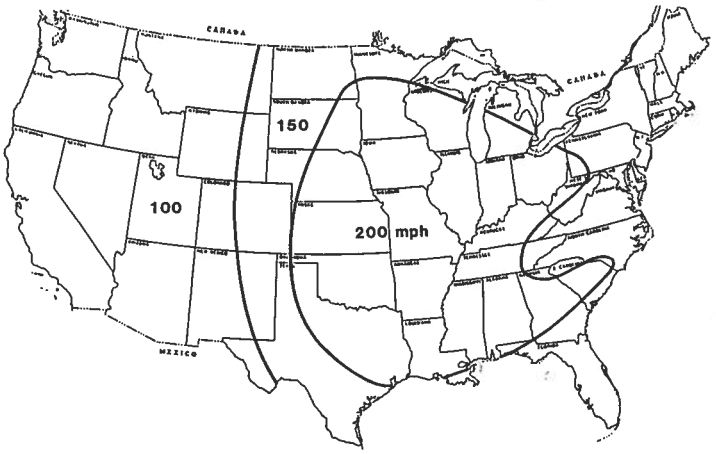


Fig. 3.2-3
Tornadic Windspeeds Corresponding to a Probability of 10^{-5} Per Year (Gust Factor = 1.0)

U.S. National Committee for the Decade for Natural Disaster Reduction Publishes Report

The U.S. National Committee for the Decade for Natural Disaster Reduction (DNDR) recently published a report entitled, "A Safer Future: Reducing the Impacts of Natural Disaster." The publication lays out the philosophy and issues a call to arms for the Decade. In 1987, the United Nations General Assembly adopted a resolution declaring the 1990's the International Decade for Natural Disaster Reduction (IDNDR). The U.S. Senate and House of Representatives endorsed the Decade concept in resolutions passed the following year. In 1989, the U.S. National Committee for the Decade for Natural Disaster Reduction was formed at the request of the federal government to develop a Decade program for the nation.

Richard E. Hallgren, American Meteorological Society, is chairman of the U.S. committee. Other committee members, familiar to the wind engineering community, include Alan G. Davenport, University of Western Ontario, George W. Housner, California Institute of Technology, Leslie E. Robertson, Leslie E. Robertson Associates, and Emilio Rosenblueth, Universidad National Autonoma de Mexico. The Commission on Geosciences, Environment and Resources, National Research Council also contributed to the publication.

The Committee proposes a multidisciplinary program that integrates the following elements: hazard and risk assessment; awareness and education; mitigation; preparedness for emergency response, recovery and reconstruction; prediction and warning; strategies for learning from disasters; and international cooperation. The report sets forth recommendations for each element.

Strategies for disaster reduction have been established by the Committee. Lives can be saved and losses substantially limited by the year 2000 by:

- identifying the areas of greatest risk to focus limited resources where they are most needed,
- increasing public awareness of vulnerability,
- implementing hazard mitigation policies and practices
- preparing for emergency response, recovery and reconstruction,
- improving prediction and warning capabilities,
- learning from disasters to prevent the repetition of mistakes and promote the use of successful techniques, and
- sharing information and experience worldwide.

In the section on learning from disasters, the Committee recommends that data on the physical, biological, social and health aspects of disasters be systematically collected and shared and that the resulting lessons learned be incorporated into policy and practice to reduce the impacts of future disasters. To achieve this goal, the Committee proposes that:

- guidelines for documenting the effects of natural disasters be developed and adopted,
- information resulting from postdisaster studies be shared, and
- disaster reduction programs and legislation be developed for rapid implementation after an event.

The WERC Board of Directors at their last meeting discussed, but took no action on the role WERC should play in postdisaster documentation and subsequent analyses of windstorm damage. The opportunity to cooperate with other organizations participating in the DNDR should be fully explored as we move into the decade of the 90's.

Copies of the 67-page report can be obtained from
National Academy Press
2101 Constitution Avenue, NW
Washington, D.C. 20418

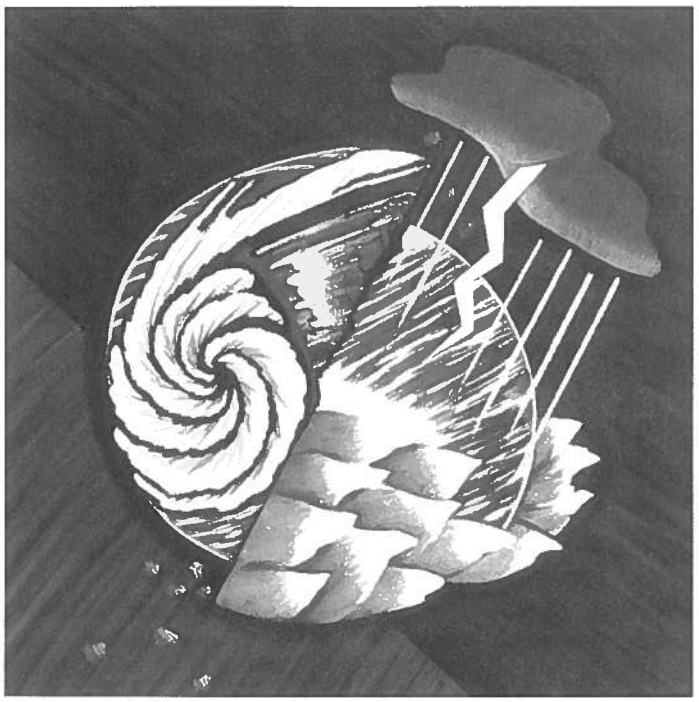


Photo art courtesy of the United Nations

A SAFER FUTURE

Reducing the Impacts of Natural Disasters

Announcement of a Short Course

ENGINEERING FOR EXTREME WINDS: 1992

A two and one-half day short course entitled *Engineering for Extreme Winds: 1992* will be presented at Texas Tech University on February 5-7, 1992 by the Institute for Disaster Research and the Wind Engineering Research Center. The faculty presenting the course includes Drs. Kishor Mehta, James McDonald, Joseph Minor, Scott Norville and Richard Peterson. This course, offered annually, should be of interest to architects, engineers, building officials, and other personnel who are involved with the design of buildings to resist extreme winds including tornado and hurricane winds, as well as individuals involved with interpretation of wind load standards and codes. The topics to be discussed include wind load concepts, interpretation of the ASCE 7-88 standard (formerly ANSI A58.1), design for hurricane winds, design for tornadoes, and window glass design. A set of lecture notes, a copy of the ASCE 7-88 standard, and a guide to the use of the wind load provisions will be provided to each attendee.

For additional information and application forms, contact Birgit Rahman or Martha Hise, Division of Continuing Education, Texas Tech University, 2579 South Loop 289, Box 130, Lubbock, TX (PHONE: (806) 745-3300 or FAX: (806) 745-0242.

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