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Wind Speeds in Europe

by Dr. Keith J. Eaton[1]

WERC Members may be interested to know of the current situation in Europe with regard to wind loading codes and, in particular, wind speeds used for structural design purposes.

Europe is approaching a considerable change in the process of using codes and standards. Harmonized Eurocodes are being drafted and these will gradually replace all the separate national standards in each country. The loading codes are included in this process, and the rules for wind loading design will naturally form an important part of the 'Eurocode for Actions on Structures'.

Fortunately the number of wind engineering experts who are involved with code drafting is relatively small, and therefore there is considerable overlap in the membership of the various committees. This, of course, leads to some agreement in the technical approaches adopted. There are some similarities (and some discrepancies!) between the International ISO Code, the ECCS Recommendations, the draft Eurocode, and the various national standards. Currently the Recommendations published by the European Convention for Constructional Steelwork (ECCS) are the **only** guidelines for designers which include design wind speeds in all the 18 Western European countries, and which include rules for the design of both static and dynamic structures.

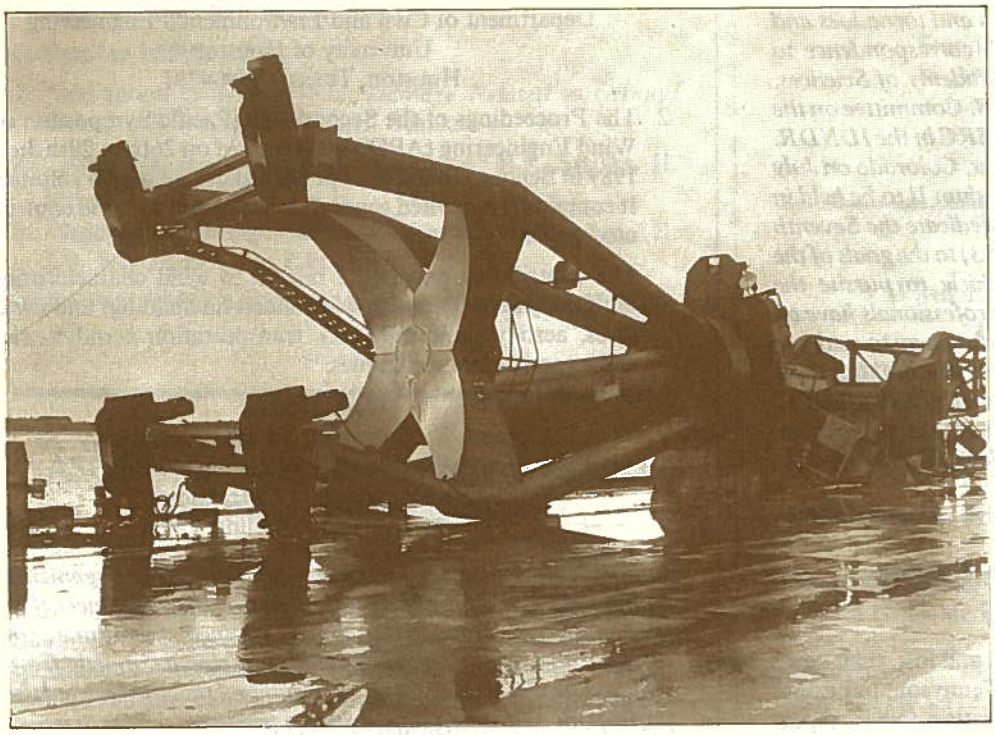
The ECCS map of reference wind speeds has been obtained from a mixed collection of national meteorological data. It is presented as 10 minute mean speeds at 10m height over flat ground with a return period of 10 years - the values ranging from 20 m/s to over 36 m/s. Other factors are then presented to vary all the relevant parameters and calculate the design wind speeds.

It is anticipated that the Eurocode drafting committee will consider the information contained in this ECCS publication for possible Eurocode use. In the meantime the ECCS Recommendations are already used in several countries in the absence of up-to-date national standards.

Should WERC Members or anyone undertaking wind loading designs in Europe wish to have more details, the ECCS Report No 52, 'Recommendations for calculating the effects of wind on buildings and structures' (1987) can be obtained from

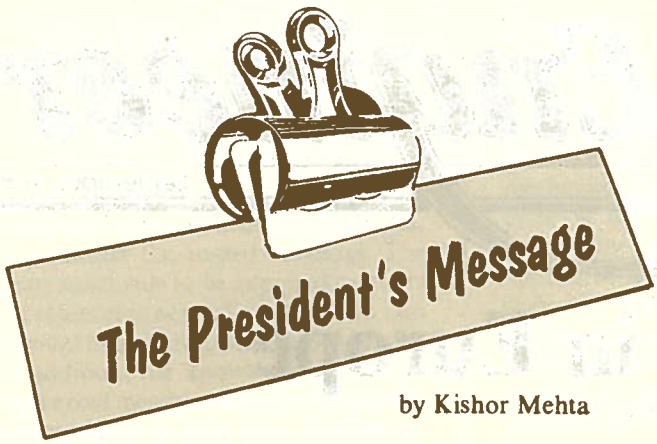
European Convention for Structural Steelwork
Avenue des Ombrages,
32/36 - bte 20
1200 BRUSSELS
Belgium

[1]*Chairman of ECCS TC 12, Steel Construction Institute Ascot, Berks, England.*



Dockside crane blown along rails and through end-stops

From "The October gale of 1987: in the Southeast of England" *by P.S.J. Buller, Building Research Establishment, Watford, England.*



by Kishor Mehta

You are probably aware that 1990-2000 is designated as an International Decade of Natural Disaster Reduction (IDNDR). Impacts of hurricanes and tornadoes, along with other natural disasters, have been increasing as the world population grows, urban concentration increases, land use in coastal areas proliferates, and hazardous structures are accumulated. The objectives of the IDNDR are to reduce loss of life, property damage, and social and economic disruption from natural hazards. Its objectives should be pursued by accelerating the application of known knowledge, identifying gaps in knowledge, and developing knowledge that can substantially improve disaster mitigation practices.

The United Nations has endorsed the designation of the IDNDR and has established a committee to organize its involvement. Many countries, including the United States, have established national committees to organize the implementation of the IDNDR in their respective countries and to provide liaisons with other countries. Two of our members, Les Robertson from New York and Alan Davenport from Canada, are members of these committees.

As the decade progresses, the WERC has a role in identifying knowledge gaps in the effects of hurricanes and tornadoes and assisting in technology transfer. Through correspondence to Frank Press, president of the National Academy of Sciences, and Richard Halgren, Chairman of the U.S. Committee on the Decade, I have indicated the role of the WERC in the IDNDR. The WERC Board, at its meeting in Boulder, Colorado on July 15th, agreed to sponsor a Tornado Symposium II to be held in Oklahoma during April 3-4, 1990 and to dedicate the Seventh U.S. Conference on Wind Engineering (1993) to the goals of the IDNDR. These conferences are one vehicle to pursue the objectives of technology transfers. We as professionals have an obligation to assist in the use of known technology to mitigate disasters. I ask each of you to provide input to the building code requirements, to follow prudent professional practice, and to assist in the retrofitting of hazardous structures to mitigate disasters caused by hurricanes and tornadoes.

Engineering Research Center Losers and NSF

'Tis better to have submitted a proposal and lost, than never to have submitted a proposal at all - not Tennyson, but rather the verdict of a National Science Foundation (NSF) report evaluating what, if any, benefits were derived by laboratories whose proposals for Engineering Research Centers (ERC) were declined by the foundation.

In interviews with 49 principal investigators, whose highly rated proposals submitted during 1985-87 NSF declined to fund, the foundation learned that in many instances the labs still benefited from the time-consuming and expensive process of formulating an ERC proposal.

According to the report, participation in the proposal process led to the creation of four ERC-like centers and two smaller centers where none had existed before. In addition, the process prompted substantial expansion and refocusing of 15 existing organizations. And significant lasting shifts toward integrated multidisciplinary research occurred in six cases, according to the report.

In 27 of the 49 cases studied, "meaningful positive outcomes" were reported, notes the study.

In the four-year history of the ERC program, NSF has funded 18 of the 378 proposals.

Proceedings Available for Two Conferences

1. The Proceedings of the Sixth U.S. National Conference on Wind Engineering held at the University of Houston, Houston, Texas during March 8-10, 1989, are available from the Conference Secretariat. The Proceedings are bound in two volumes and contain approximately 1200 pages. The conference highlights include four invited theme lectures, a special invited session on Recent Innovations and Future Challenges in Wind Engineering, and the twenty-seven contributed sessions.

   Cost: $60.00
   Contact: Professor Ahsan Kareem
   Department of Civil and Environmental Engineering
   University of Houston
   Houston, Texas 77204-4791

2. The Proceedings of the Second Asia-Pacific Symposium on Wind Engineering (APSOWE II), held on 26th to 29th June 1989 in Beijing, China, were published in a set of two volumes. It contains nine invited general review papers and 138 contributed papers.

   The contributed papers are related to wind characteristics, bluff body aerodynamics, wind effects on buildings and structures, aerodynamic diffusion, transportation aerodynamics and experimental techniques.

   Cost: $150.00
   Contact: Professor Bo-yin Zhang, Secretary
   Chinese Society for Wind Engineering
   c/o Department of Mechanics
   Peking University, Beijing, China

Editors Note: Professor T.F. Sun, Chairman of the Organizing Committee, has advised the Editor of the Wind Engineer that the conference was held - as originally planned - from June 26th to June 29th, 1989. There were 100 participants, mostly from China. The Organizing Committee advised that they missed the participation of their many overseas friends.

An Editorial Comment

A state statute was passed by the Florida legislature in June 1989 omitting the requirements for wind loadings on one and two-story residences outside of the 1500 foot coastal zone of Florida. The measure was passed at 2 a.m. at the end of a chaotic session of the legislature, without review by engineers, architects, or the full construction industry. Rationale behind this unfortunate measure was the need for "affordable housing". Unfortunately, this legislation will equate "affordable housing" to "expendable housing". The impact of this legislation was to eliminate a reasonable degree of protection that Floridians expect their homes to provide in windstorms and hurricanes.

Fortunately, the legislation did permit the State Board of Building Codes and Standards - an appointive Board of the Governor - to reinstate the wind load requirements for one and two-story residences, after a public hearing. The Building Codes Board at its July 26th meeting **did** reinstate wind load requirements for all residences in all parts of Florida, on a 90 day emergency basis.

Of interest to WERC members is the fact that the WERC Board passed a resolution recommending that all localities in Florida follow rational wind load design and construction requirements for **all** buildings. This resolution was transmitted to the Building Codes Board by the Editor of the Wind Engineer, at its July meeting, and was given consideration by the Building Codes Board in its passage of the remedial rule.

Herbert Saffir, P.E.
Editor

WERC RESOLUTION

Whereas, the Wind Engineering Research Council, Inc. (WERC), a non-profit professional organization, is committed to disseminate research results to professionals and has recently communicated its concern to Governor Bob Martinez, State of Florida, on June 22, 1989 in regard to CS/HB 1057; and

Whereas, the results from post-disaster investigations by wind engineers and meteorologists have pointed out repeatedly the high vulnerability of light-framed, one- and two-story buildings to the effects of extreme winds; and

Whereas, the WERC encourages implementation of decision-making bodies of the recommendations derived from these post disaster investigations as well as from research studies; and

Whereas, the passage of this bill will have a devastating impact on the performance of future construction in the State of Florida during extreme wind events,

NOW, THEREFORE BE IT RESOLVED THAT: the WERC Board of Directors at its meeting on July 15, 1989 in Boulder, Colorado, unanimously recommends that the Florida State Board of Building Codes and Standards - as authorized in this statute - shall require ALL localities in Florida to follow rational wind load design and construction requirements for ALL buildings and other structures, including all one- and two-story structures and buildings used for single-family, two-family, and multi-family dwellings.

Fujita/Jumbo Outbreak Anniversary Tornado Symposium

A two-day Tornado Symposium will be held in Norman, OK, on the anniversary of the 1974 Jumbo Tornado Outbreak, April 3-4, 1990. This timing is to coincide with, and to honor the award of the University of Chicago's Merriam Distinguished Professorship to Dr. Ted Fujita, a pioneer in tornado research. The 1990 date will also coincide with the commencement of the field deployment of the new operational radar network, NEXRAD. The Symposium will be jointly hosted by the National Severe Storms Laboratory, the Oklahoma National Weather Service Forecast Office, the NEXRAD Operational Support Facility, and the University of Oklahoma's School of Meteorology, Cooperative Institute of Mesoscale Meteorological Studies, and Center for Analysis and Prediction of Storms. Sponsors include NOAA (the National STORM Program), the Office of Naval Research, the Wind Engineering Research Council and other agencies.

More than half of the papers presented will be invited from distinguished experts in the meteorological, wind engineering and natural hazards mitigation communities. The emphasis will be on review paper and tutorials, not new or individual research. For those wishing to submit papers, a 500-word abstract should be sent to the Program Committee as soon as possible.

Submit abstracts to:
Tornado Symposium II Program Committee
c/o National Severe Storms Laboratory
1313 Halley Circle
Norman, OK 73069

Contact:
Joe Golden, NOAA for additional information (phone 301-427-7386)

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Design and Aerodynamic Characteristics of the University of Minnesota Boundary Layer Wind Tunnel

by
Cesar Farell[1]

Design and construction of a closed circuit atmospheric wind tunnel at the St. Anthony Falls Hydraulic Laboratory, Department of Civil and Mineral Engineering, University of Minnesota, has proceeded under National Science Foundation and State of Minnesota grants. The tunnel features a 1.70 m x 1.50 m high-speed test section, 16 m long, with velocities up to 45 m/s, and a low-speed test section, 2.4 m x 2.4 m x 18 m long, with velocities up to 19 m/s, located in the return leg of the tunnel. A one floor addition atop the laboratory, with over 4,000 square feet of usable space, was completed in December of 1986 to house the facility. It will be possible to use the tunnel either as a closed or as an open circuit facility, the latter mode of operation being best suited for applications in which foreign particles must be introduced in the air stream. Furthermore, by shutting off the heating to the top floor of the laboratory, with the tunnel in the open circuit mode drawing cold air from the outside, it will be possible to operate the facility under very cold temperatures (a heat exchanger has also been provided in the circuit), thus facilitating cold regions research studies, including icing studies.

Continuing design studies of the various tunnel components have been carried out together with planned verification measurements, with particular reference to meeting the flow quality requirements set for the two tunnel test sections.

Present-day design practices for wind tunnels involve still somewhat of an art, mainly because of incomplete understanding of the behavior of turbulent boundary layers and free shear layers in diffusers, bends, corners, transitions, and fans, in particular in relation to three-dimensional effects. While there are some well established and reasonably safe rules of design which have generally permitted adequate, albeit approximate, predictions of wind tunnel performance, there is a definite need for additional research into the design of almost all components of a wind tunnel. This is particularly true if special requirements are introduced as part of the design, as is the case of the present tunnel in regard to the flow in the first and second corners and in regard to the turbulence management system. For some wind tunnel designs, scale models have been constructed in order to test different options and reduce uncertainties. An increase in the accuracy of design predictions should derive now from the availability of high speed computers and the refinements in fluid flow computational techniques developed for such computers. In any event, calibration of any new wind tunnel facility, including tests of all circuit components, should still be a priority with wind tunnel designers.

[1]*Professor of Civil Engineering, St. Anthony Falls Hydraulic Laboratory, Department of Civil and Mineral Engineering, University of Minnesota, Minneapolis.*

WERC Presents Awards for Outstanding Wind Engineering Contributions

The Wind Engineering Research Council (WERC) presented two awards for Outstanding Wind Engineering Contributions at the Sixth U.S. National Conference on Wind Engineering held in Houston, Texas on 9 March 1989. Drs. Michael P. Gaus and Arthur N.L. Chiu were presented with a plaque and certificate in recognition of their contribution to development of wind engineering.

Citations made with the certificate were as follows:

"To Michael P. Gaus in recognition of his advocacy and active support of national and international wind engineering conferences, the Wind Engineering Research Council and wind engineering research programs during 25 years of service with the National Science Foundation."

and

"To Arthur N.L. Chiu in recognition of his national and international promotion of wind engineering research and practice through initiation of Joint Research Seminars between the United States and Asian countries on wind and wind effects, compilation of Wind Engineering Research Digests for the period 1973-78, and a decade of distinguished service as a member of the Board of Directors."

The awards to Drs. Gaus and Chiu are the first made by WERC. An awards policy is being developed by the awards committee of WERC – Drs. Richard D. Marshall, Robert H. Scanlan and Jack E. Cermak (chairman) – in which a Wind Engineering Service Award and a Wind Engineering Research Award will be made at one or two year intervals.

WIND TUNNEL FACILITIES IN NORTH AMERICA

This is a continuing list of wind tunnels available throughout the world.
Supplements will be provided in future issues of the WIND ENGINEER.

NAME	LOCATION	TYPE OF WORK	CONTACT
Concordia University Center for Building Studies	Montreal, Canada	Commercial, Research	Ted Stathopoulos (514) 848-3186
Environmental Science & Services Corporation	Long Island City New York	Commercial, Research	Walter Hoydysh (718) 786-3948

ASCE Task Committee on Wind Damage Mitigation

The Task Committee on Wind Damage Mitigation, American Society of Civil Engineers (ASCE), completed its tasks in 1988. The Task Committee Report was published as a set of articles in two special issues of the *Journal of Aerospace Engineering*. They include the following papers:

In April 1989 Issue:

1. *"Wind Damage to Wood-Frame Houses: Problems, Solutions, and Research Needs,"* by H. Liu, H.S. Saffir and P.R. Sparks
2. *"Strategies for Mitigating Damage to Metal Building Systems,"* D.C. Perry, J.R. McDonald, and H.S. Saffir.
3. *"Review of Standard Practice for Wind-Resistant Manufactured Housing,"* J.R. McDonald and J.F. Mehnert.
4. *"Mitigation of Damage to Electric Utilities Due to High Winds,"* T.M. Tracy and J.R. McDonald.
5. *"Wind Design Problems with Building Structures During Construction,"* R.T. Ratay.

In October 1989 Issue:

1. *"Mitigation of Severe Wind Damage Related to Ground Transportation Systems,"* R.H. Scanlan.
2. *"Wind Damage to Masonry Buildings,"* P.R. Sparks, H. Liu, and H.S. Saffir.
3. *"Strategies for Wind Damage Mitigation -- A Summary,"* H. Liu, E.J. Turner, and P.L. Gould.

Order from ASCE, 345 East 47th Street, New York, NY 10017.

ASCE New Task Committee on Wind Damage Investigation

ASCE Aerospace Division has approved the formation of a new Task Committee on Wind Damage Investigation. The purpose of the task committee is to promote and improve the quality of wind damage investigation, and to develop a set of guidelines for publication as an ASCE Manual of Practice. Individuals interested in the activities of this committee should contact Herbert S. Saffir who is chairman of this committee.

NEW WIND LOAD STANDARDS

Australian Wind Code, AS 1170.2-1989

This new Australian standard is a complete revision of the previous standard. Major changes include the adoption of limit state format with separate design wind speeds being specified for **ultimate strength design**, **permissible strength design** and **serviceability design**; the inclusion of a separate simplified section for small structures up to 15 m high; a detailed section on dynamic analysis; greater emphasis on topographical effects; allowance for the effect of shelter from other structures in urban environments; and separate velocity profiles for tropical cyclone winds.

Of special interest in hurricane-prone areas, are the requirements for testing cladding and connections to simulate fatigue loading; fatigue test loading sequence calls for over **10,000 test cycles** at varying percentages of ultimate design wind pressures. No test requirement of this type exists in U.S. Standards.

The Standard is available at a cost of $55.00 from:

Standards Australia
80 Arthur Street
North Sydney, NSW 2060
Australia

Wind Effects on Roofs

by

Hans J. Gerhardt[1], Carl Kramer[2]

The highest windloads on external building surfaces occur on building roofs, in particular flat roofed buildings. The large windloads to be expected on roofs are sometimes not sufficiently taken into account in building codes and standards. In addition, the knowledge of how to secure roof membranes and roof elements appropriately is quite often insufficient. This results in major damage of roof surfaces observed every year.

The Fluid Mechanics Laboratory of the Fachhochschule Aachen and WSP Consultants for Heat Engineering, Fluid Engineering and Process Engineering have been actively involved in wind load codification and research and development projects for the roof industry over the past 15 years. The early research work emphasized the determination of realistic windloads on the outer surfaces of buildings having basic shapes; the result has been incorporated in the new German Code of Practice (DIN 1055 Teil 4). Recent research has been concerned with the safety against wind lift-up of roofing systems, such as loose laid pavers and insulation boards on flat roofs and loose-laid, mechanically fixed single-ply roofing membranes. Research grants from the Federal Government of Germany and the State Government of Northrhine-Westfalia have been used to draft proposals for both topics to be incorporated into the appropriate Codes and Standards in the future. In particular, a procedure for proof testing of mechanically fixed single-ply membranes has been drafted, which has been agreed upon by the approved Testing Institutes in the EC-countries and will be implemented in the near future.

The test procedure takes into account the dynamic behavior of the wind and its influence on the fatigue behavior or mechanical fixation systems. The load cycle is based on the wind velocity probability distribution. It has to be applied to a roof specimen set up full scale with typical dimensions of 6 x 1.5 m. The wind gust action is simulated by applying appropriate suctions to the roof surface in the roof test facility. The pressure in the suction chamber is adjusted to give theoretical fastener loads of W(100%) = 300 N for the first four cycles and increased fastener loads (in increments of W(100%) = N) for the consecutive cycles. The test is continued until roof failure.

Almost all European roof membrane and roof fastener manufacturers have implemented the know-how provided by the authors, in their instructions and technical data. This has contributed to a significant decrease in roofing problems in Germany and other European countries. From existing knowledge, the fastener patterns commonly used to secure single-ply roofing membranes on industrial buildings in North America have to be judged insufficient. Consequently, WSP Consultants have been involved over the last few years in some large North American projects. This work included the proof testing of the roof fixation system used on the Toronto Skydome and studies on wind induced roof damage on large industrial complexes and proposals for refastening of those roofs.

[1,2] Professors, Fluid Mechanics Laboratory Fachhochschule Aachen, W. Germany and principals, WSP Consultants.

5 Year Plan for Wind Engineering Research Council

At the recent Board of Directors meeting held on July 15, 1989, Dale Perry presented his Planning Committee report to the Board. The report was prepared by Perry, at the request of the Board, with the assistance of Herbert Saffir, Peter Sparks and Dick Marshall.

Items agreed to in the report, by the Board, in principle, were:

- Mount a substantial effort during 1990 to increase membership, both individual and corporate.
- Organize a continuing series of workshops that address various issues of concern to the wind engineering community.
- Establish a standing committee on codes and standards.
- Involve WERC in the National Hurricane Conference and the Florida Governor's Hurricane Conference.

The following priorities were set for workshops/conferences/symposiums; individuals or organization taking the lead are indicated:

a. Hurricane Winds: Dale Perry and Herb Saffir

b. Roofing/Wind Uplift Issues: Texas Tech University/Colorado State University

c. Insurance/Wind Hazard Issues: Jim McDonald

d. Prescriptive Building Code Requirements: Jim McDonald

e. Field Measurements: Nick Isyumov and Kishor Mehta

Perry was asked to prepare a one-page summary of the proposed five year plan for future submission to the Board.

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