THE WIND ENGINEER

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American Association for Wind Engineering

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Presidents Message

By: Ahsan Kareem, President of AAWE

Greetings and best wishes for a healthy and productive new year from myself on behalf of AAWE and the University of Notre Dame. I am sure you have noticed the absence of Professor Jim McDonald, who stepped down as editor of Wind Engineer due to his new administrative assignment. This transition has unfortunately resulted in a prolonged delay in the production of the Wind Engineer. Further changes in the AAWE officers include the assignment of Dr. Greg Chiu in Hong Kong. Both these gentlemen should be thanked for their dedicated service to AAWE. On a brighter note, I am pleased to announce the agreement of Dr. Partha Sarkar of Texas Tech to serve as acting Secretary/Treasurer for the remainder of my term.

However, though some administrative changes have led to delays in the timely distribution of the Wind Engineer, these changes have not affected our pursuit of the cause of wind engineering research/development and technology transfer. We have completed a major report entitled "New Opportunities to Reduce WInd Hazard Losses and Improve the Quality of Life in the USA," of which I am confident you've all received a copy. However, should you require additional ones, instructions for downloading the document from the web site are given in the newsletter and a few of the initial hard copies are also still available.

Furthermore, we have organized a workshop on Large Scale Testing Concepts for Structures at NSF, under the sponsorship of NSF/NIST, to explore the needs and suitability of a system for large scale testing. While a report for each of you is in preparation, for the time being, you may find details in this newsletter. Another workshop was held last December at Johns Hopkins University to plan for the formulation of a national program for wind hazard reduction. A short prospectus is also being prepared to highlight its details.

As most of you attended the 8th US National Conference on Wind Engineering at Johns Hopkins University, I don't need to reiterate its tremendous success. Remember that the proceedings are still available on a CD ROM from Professor Nick Jones, who also should be commended for his successful organization of this important event. As you may recall, the closing session of this meeting brought the notion of broadening our horizons for future gatherings. It was decided to change the name of this conference, which is held every four years, to The American Conference on Wind Engineering. By this measure, we are extending a warm and official welcome to our colleagues in Mexico and South and Central America to join hands in this event. (Our Canadian colleagues have been very active from the beginning of the conference series.)

Moving on, under the aegis of AAWE, a small delegation attended the 29th UJNR Panel on Wind and Seismic Effects in Tsakuba, Japan this summer, where I was fortunate enough to present an overview of wind engineering research in the US as the opening paper of the meeting. On a lighter note, I also managed to lead the US tennis team to a stunning victory, bringing the coveted tennis trophy back home.

Furthermore, our members have been actively participating in meetings related to wind hazard reduction. For my own part, I made a general presentation entitled, "Jousting with the Wind: A Reflection on Past Lessons and Outlook for the 21st Century," at the plenary sessions of the 1997 Hurricane Conference, and at the 7th International Conference on Structural Safety and Reliability, where I delivered a talk titled "How to Cope with Low Frequency, High Impact Disasters - a Wind Engineering Viewpoint." In addition, others have made presentations at several FEMA regional meetings and other mitigation conferences.

Before I conclude this address, I would like to turn your attention to the disasters which impacted us recently and our role in gathering post-disaster information. As you are well aware, El Nino did grace the Atlantic Coast with a very inactive hurricane season, while more than compensating for this out on the Pacific Side. Though there were cases of extreme local flooding, most of these Pacific storm tracks did not expose any territory to harm's way, especially in the form of strong winds; therefore, we did not have to disperse any post-disaster teams. Late last December, Typhoon Paka battered Guam with strong

winds and flooding. As a result, the AAWE nominated one of its members to the NOAA team to visit the area and collect useful information on any damage due the extreme winds which were reported.
In light of recent disasters and the necessity to document the damage following such events, our Post-Disaster Committee has begun brainstorming in order to clearly define AAWE's role in such investigations, since a very large number of other organizations are sending out teams, making coordination very difficult. One plan is for AAWE to focus on accurate assessment of wind speed distributions in the region through close cooperation with NOAA. Currently these plans and dialogues with different groups are underway, and a report is being prepared for further consideration. Your input on such matters is quite necessary and will be very much appreciated. Our intent is to finalize our role in post-disaster investigations before the 1998 hurricane season, which promises to be a busy one.
Finally, you may recall your pleasant surprise when you did not receive a bill for your 1997 dues. This was for a number of reasons including infrequent issues of the Wind Engineer, but rest assured: you will soon be hearing from us regarding the dues for 1998 and also for the election of office holders, as my term as AAWE President nears completion. I will write to you again once more to summarize the highlights of our accomplishments and remaining challenges, and introduce you to the new officeholders. Until then, I wish you success in your endeavors and safe travels as you further the cause of Wind Engineering.

AAWE Report

Wind Engineering: New Opportunities to Reduce Wind Hazard Losses and Improve the Quality of Life in the USA

By: Michael P. Gaus

An overview report was prepared under the direction of a committee of AAWE to help to outline some of the opportunities which could be developed through an integrated effort between engineers, meteorologists and other participants in working toward more effective wind hazard mitigation. This report is presented in two sections: The Current State of Affairs, and Establishing Our Future Direction. The report is intended to build on and add to the material presented in previous reports such as the National Academy of Engineering and the NIST report of Research Needs in Wind Engineering.

In particular the report discusses some of the difficult issues in achieving more effective wind hazard mitigation such as the fragmentation of the industry responsible for final delivery of the constructed products which are at risk in extreme winds, the problem of existing as well as new constructed facilities, the problems of achieving a more rapid rate of technology transfer of new research knowledge, the problem of developing curricula which would help to educate engineers and architects in important aspects of wind problems, and the need to continue improving the level of research activity in the meteorological, engineering and sociological aspects of wind hazard problems.

The report points out the need to develop a comprehensive national plan for wind hazard mitigation which would bring together the efforts of government, industry, insurance and trade associations, universities and the public in working toward a common goal. A difficult problem which must be dealt with in gaining public acceptance of a national plan is the difficulty of coming up with a "magic bullet" in which a quick and maybe intensive effort would provide a quick fix to the problem. This is certainly not possible due to the huge existing investment in constructed facilities of which many would be in peril if struck by extreme winds. An effective national plan must consider existing as well as newly constructed facilities and must represent a long-term and constant effort covering a broad scope of activity.

Other issues such as the need to develop targeted experimental facilities for wind hazard mitigation and the possible impact of computational fluid mechanics and other new physical and information technologies are briefly covered in the report.

A small section containing sample recommendations is also included in the report to stimulate further discussion and development of this important subject.

Copies of the report were mailed to AAWE members in Sept. 1997 and a complete copy of the report is available on line at the wind research web site http://www.civil.buffalo.edu/wind/windneeds.htm. A limited number of printed copies are still available where printed copies are needed.

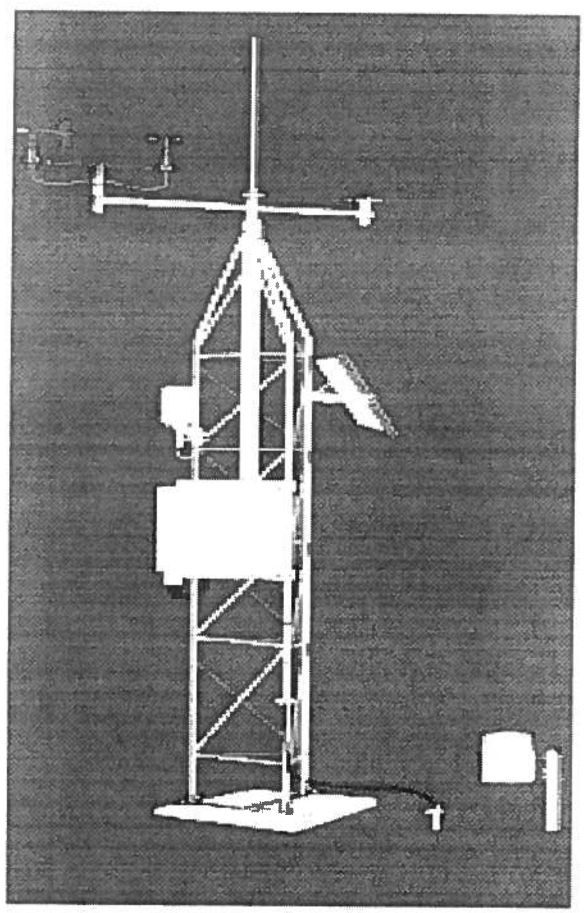
RWIS in Our Future

By: Michael P. Gaus

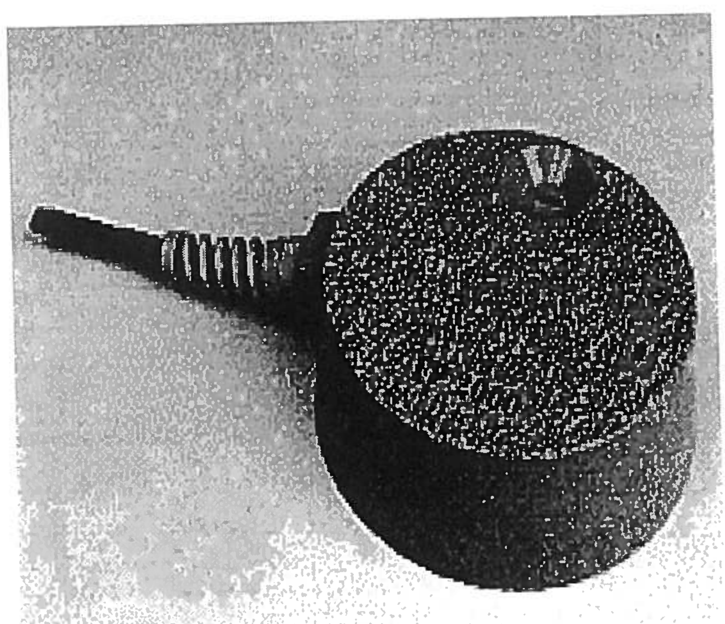
An interesting development which should be of great interest to wind engineers is the rapidly emerging introduction of Roadside Weather Information Systems. The motivating factor behind the introduction of these systems is the massive investment in Intelligent Highway Vehicle Systems and associated technologies. Among the objectives of the IHV efforts is to improve the safety and throughput of highway systems. Included in the safety concerns are the detection of conditions which would be hazardous to vehicle travel and/or weather and natural hazard conditions which would compromise vehicle flow. Among these conditions are strong winds and snow and ice conditions.

Conventional weather information sources are not adequate for detailed evaluation and planning of snow and ice control and removal strategies along transportation systems as they are too sparsely located and may have too high an emphasis on higher elevation winds as opposed to the surface winds which would be of direct importance to vehicle movement and safety. As a result there has been a large effort to develop specialized RWIS systems to provide information which is not currently being developed through conventional sources.

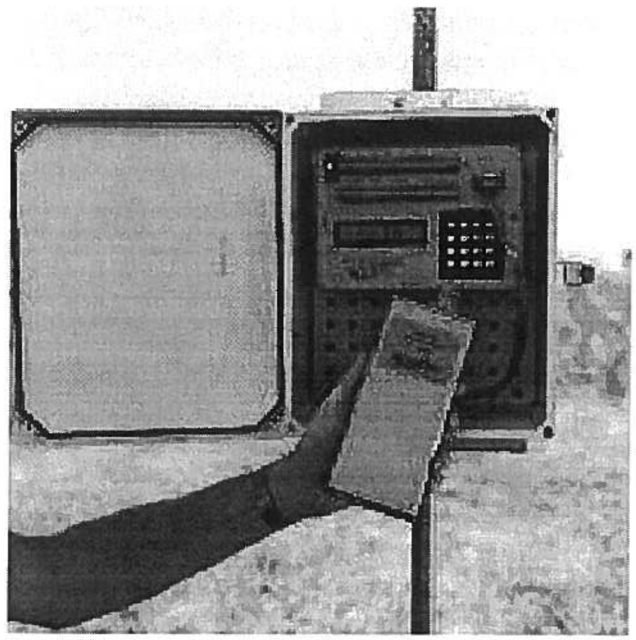
Interestingly enough it appears that the development of the RWIS systems is largely devoid of input from wind engineers. It would appear that the development of these systems could greatly benefit from the input of wind engineers and conversely the rapid deployment of these RWIS facilities could provide a large amount of useful information of great value in overall wind engineering activities. A couple of experimental RIWS installations are shown below.



included in these systems is a capability to incorporate other types of sensors which can be utilized in the data logging system. An example of a sensor which can be embedded in a pavement to report information on moisture, snow and ice is shown below:



The data loggers for these systems have a capability to pre-process data to use available band-width for optimizing information transfer and have a capability to locally store information for future download, to utilize phone lines, rf and wireless transmission or cellular phone capabilities to transmit data. An example of a data logger is shown below:



As anyone who deploys unmanned field instrumentation knows there is a seamy side of humanity which must be dealt with and the RWIS systems in the future will have to provide a robust capability to withstand the assaults of natural, human and vehicle systems. Thus there is the opportunity to incorporate these systems in solving a past problem of wind and weather data collection - the loss of instrumentation at a point where extreme loading information is most needed. It would appear that there may a synergistic opportunity for AAWE to establish a committee to provide an interaction with the RWIS efforts in progress to improve both the IHV use of data and to incorporate this information in improving the picture of the overall wind climate on a regional basis for more general wind engineering applications. By incorporating this information with a GIS approach it will be possible to provide a much more satisfactory information source on wind climatology for wind engineering purposes. Who knows- maybe we would be lucky enough to have a hurricane or tornado pass over a robust RWIS station which continues recording throughout the event.

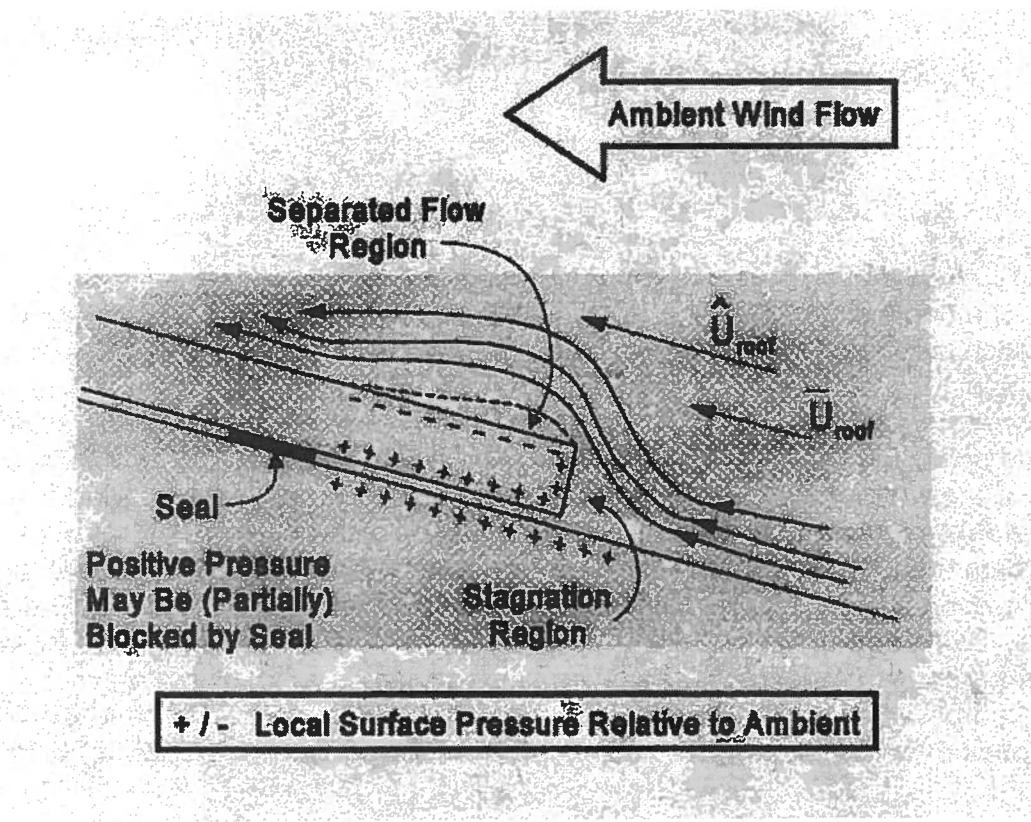
Expanded Wind Research Program at Texas Tech University

Wind Engineering received a major boost as a result of recent Congressional action. On 11/26/97 President Clinton signed Public Law 105-119 which provided appropriations for the Department of Commerce which includes the budget for National Institute of Standards and Technology (NIST). Included under the NIST budget was an amount of $3.8 million for wind research at Texas Tech University. This appropriation will be administered by NIST through a cooperative agreement with Texas Tech University. The wind engineering community will greatly benefit from this continuation and extension of wind engineering research activities at Texas Tech University. We will look forward toward hearing about the new initiative at Texas Tech University.

New Developments on Uplift of Shingles by Wind

by: Jack E. Cermak and Jon A. Peterka

An understanding of the uplift mechanism for sealed asphalt shingles and a quantitative relationship between uplift force and mean approach wind speed at roof height has been developed. This was accomplished by wind-tunnel studies in the Meteorological Wind Tunnel of the Fluid Mechanics and Diffusion Laboratory at Colorado State University (CSU) and full-scale measurements at the Cermak Peterka Petersen, Inc. (CPP) wind-engineering field site. This entire effort was sponsored by the Asphalt Roofing Manufacturers Association (ARMA). The uplift mechanism, pressures caused by flow over a shingle, is depicted as follows:



A shingled deck (1.22 x 0.91 m) set at slope of 4:12 was used for the initial wind-tunnel study. Simultaneous measurements were made of pressures at an array of points on top and bottom surfaces of a shingle, wind speed at 25 mm above the shingle and wind speed approaching the deck. Differential-pressure coefficients were obtained from these data. Measurements of the ratio of wind speed above the shingle to mean wind speed approaching a building were made in a second series of wind-tunnel studies. Tests made on T-shape buildings (1:25 scale) with gable roofs of slopes 2:12, 5:12 and 9:12 in a boundary-layer flow revealed the upper bound of this ratio to be 2.5. A quasi-steady hypothesis was made (and confirmed) to relate the desired peak differential coefficients to the mean coefficients. A field site installation was designed and constructed to perform similar measurements on a full-scale building to check validity of the wind-tunnel results. The building mounted on a rotatable base is 7.0 x 10.7 m in plan with an eave height of 3 m and a 5:12 slope gable roof. Wind data were obtained at heights of 3, 6, 10 and 60 m. The full-scale and wind-tunnel results were found to be in good agreement. Accordingly, the uplift model developed for sealed asphalt shingles can be used with confidence for product development. Further studies are in progress to develop uplift models for the not too infrequent case of unsealed shingles. Details of the studies and the quantitative uplift model are presented in a recent publication • Peterka, J. A., Cermak, J. E., Cochran, L. S., Cochran, B. C., Hosoya, N., Derickson, R. G., Harper, C., Jones, J. and Metz, B. (1997). • Wind uplift model for asphalt shingles.• *Journal of Architectural Engineering*, ASCE, Vol. 3, No. 4, pp. 147-155.

8th US National Conference on Wind Engineering

Dr Nicholas P. Jones and the Department of Civil Engineering at the Johns Hopkins University in Baltimore hosted the 8th US National Conference on Wind Engineering which was held on the Johns Hopkins Homewood campus June 5-7, 1997. The conference attracted around 200 participants, including a large number of students, from the US/Canada, and from as far afield as Hong Kong, Japan, and Ukraine. "Nontechnical" highlights of the meeting included an icebreaker reception at the Peabody Conservatory Library and a banquet at the Baltimore Museum of Industry. Conference proceedings are available to anyone interested on a CDROM for a nominal charge. Papers from the conference were reviewed for a special issue of the Journal of Wind Engineering and Industrial Aerodynamics which is now in production and should be available later this year.

The conference was sponsored by AAWE, the National Science Foundation, the Whiting School of Engineering at Hopkins, and by various local and national private sponsors. This support is gratefully acknowledged.

Details of the conference (including paper abstracts) can be found at http://rongo.ce.jhu.edu/eighthusncwe/ or obtained by contacting:

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Report on Workshop on Large-Scale Testing Needs in Wind Engineering

By: Michael P. Gaus

A special AAWE workshop on Needs for Large-Scale Testing Facilities for Wind Engineering was held in Washington, DC in May 1997with sponsorship from the National Science Foundation (NSF) and the National Institute for Science and Technology (NIST). Workshop participants came from the US, Canada, Australia and the United Kingdom and provided inputs representing both fluid mechanics and structural experience with respect to wind problems. Presentations provided information on existing wind tunnel facilities in the US and abroad and on facilities for special testing for wind sensitive systems such as glass and cladding and roofing systems.

Several novel full-scale concepts were presented including the "Wall of Wind" concept developed under the sponsorship of the Idaho National Engineering Laboratory. This proposed facility would be of sufficient size such that full-scale residential or other structures could be tested to destruction in the facility. The driving power for the facility would be banks of Russian "Bear" aircraft engines. Other testing concepts presented included the use of controlled structural loading systems which could simulate the loadings produced by actual wind forces.

After the presentation of individual reports the Workshop participants formed a series of groups to discuss needs for large-scale testing in wind engineering and each group prepared a summary report. The Group Reports are:

- Critical Research Areas Requiring Large-Scale Testing
- Large-Scale Testing in Natural Wind
- Large-Scale Testing in Artificial Wind
- Large-Scale Testing in Modeled Wind
- Testing and Computing for Synthetic Wind

The overall discussion of the Group Reports and general topic demonstrated that in a problem as complex as the wind loading of various facilities and the resulting performance responses there are a large number of possible approaches and differing needs. Each approach must be evaluated in terms of the potential cost-benefits which may be achieved and the opportunities to transfer new knowledge gained into practice. Workshop participants did agree that there is a need for increased large-scale testing capabilities and that researchers and industrial firms should be encouraged to pursue the opportunities for the development of additional facilities. It was also apparent that there are a number of large-scale testing facilities which have been constructed in other countries which are not being fully utilized and that cooperative efforts utilizing these facilities may be cost effective and of benefit to each of the countries involved.

The report of the Workshop is expected to be mailed to participants and interested parties at the end of Jan 1998

Super Typhoon Paka

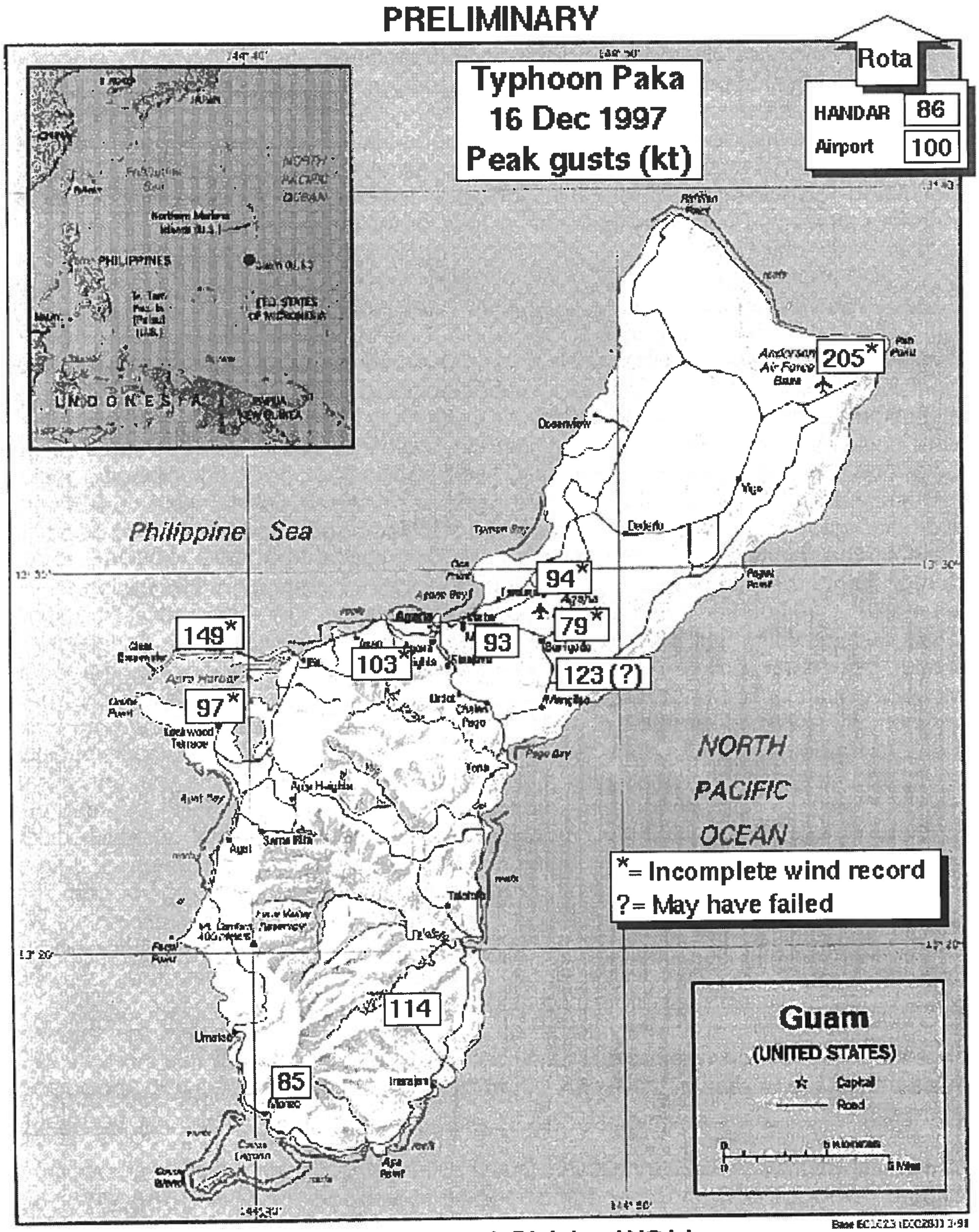
Contributed by: Mark Powell

Typhoon Paka was one of the most intense windstorms to strike the Guam region since 1962. Paka formed in the Central Pacific southwest of Hawaii on 28 November 1997. Paka tracked steadily westward for two and one half weeks before slamming into the islands of Guam and Rota. As Paka's eye passed over northern Guam, destructive winds caused extensive damage to private and commercial buildings, infrastructure, crops, and vegetation. More intense than typhoons Pamela (May 1976) and Omar (August 1992), Paka, with estimated maximum sustained surface winds of 130 knots gusting to 160 (150 mph gusting to 185 mph) approached, but did not exceed, the intensity of Karen (estimated 135 gusting to 165 knots) in November 1962. No life was lost as a direct result of Paka's passage. Preliminary estimates of total losses run in the hundreds of millions of dollars.

Surface wind assessment

Considering the strength and duration of the Paka's surface winds, it is not surprising that the wind records for areas that experienced passage of the primary wall cloud were fragmentary. The approach taken with these incomplete and noisy raw data records was to work sustained wind observations against the peak wind gusts, using a standard gust factor of 1.20 to 1.25 over water (Atkinson, 1974) and 1.60 overland. For example, gusts to 120 knots over water would be associated with a sustained surface wind of 100 knots; overland gusts to 120 knots would relate to 75-knot sustained wind. This technique identifies the representative data, for example: Commercial Port NWS HANDAR at Apra Harbor reported sustained/peak gust of 100/149 knots which is plausible; Andersen AFB anemometer 96/205 knots is not considered representative. The Commercial Port sensor failed after recording four hours of 135 to 149 knot gusts in the wall cloud, Andersen AFB sensor lost power during passage of the western wall cloud. Additionally, the NWSO sensor at Tiyan lost power during the onset of the primary wall cloud, the NPMOCW/JTWC anemometer at Nimitz Hill failed at 103 knot before the wall cloud arrived, the wind bird at the Apra Harbor failed in the wall cloud, and the NWS HANDAR at the University of Guam, Mangilao weathered the storm to report a peak gust to 123 knots. In the final analysis the HANDAR instrument at Apra Harbor becomes the benchmark. It faithfully recorded peak gusts up to 149 knots until the winds began backing to the southwest, at which point it failed This implies that the later southwesterly flow or second wind was stronger than the initial northwest to west wind (or first wind). This is borne out by the reports from other records at the Rota HANDAR and airport, DanDan and Merizo. The only complete wind trace that records the peak winds in the wall cloud and the relative calm within the eye was from the Kuentos Communications, Inc. in Maite. Relative to the lowest pressure which occurred at the closest point of approach (CPA) of Paka, a comparison was made of the strength and duration of the highest winds on either side. The wind from the southwest after the eye passage was more intense and of a longer duration. If this increase of 10 knots at Maite is applied to the Apra Harbor benchmark, a peak gust of 160 knots can be inferred.

A map showing the preliminary assessment of estimated peak wind gusts is shown below. A more detailed report on Super Typhoon Paka is available from the NOAA web site at www.aoml.noaa.gov/hrd/storm_pages/frame.html.



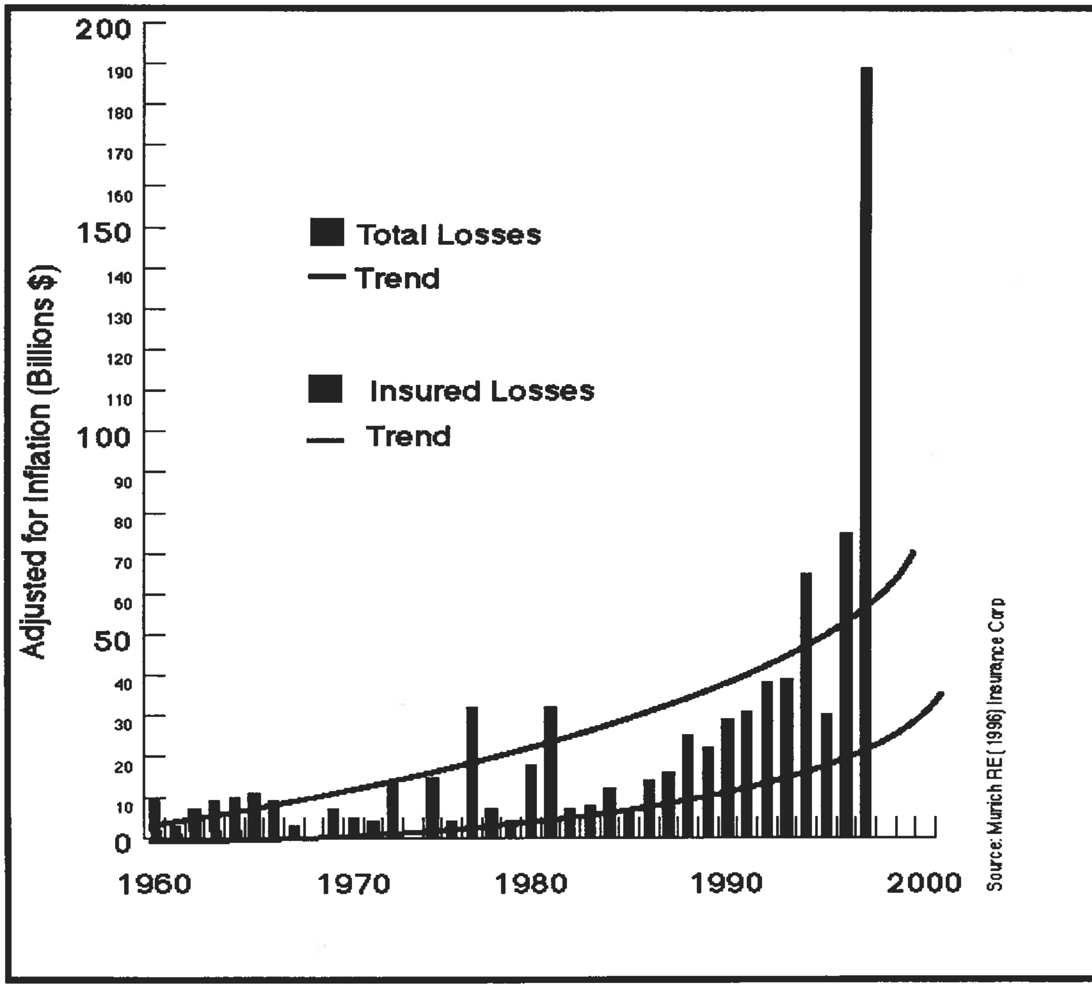
Hurricane Research Division / NOAA

Natural Disaster Reduction: A Common Agenda for NOAA and the Nation

Contributed by Joe Golden

Natural hazards threaten lives, property, natural resources and the vitality of local and regional economies throughout the United States. These events commonly include severe weather (hurricanes, tornadoes, winter and ice storms, heat, droughts and floods), geophysical activity (volcanoes, earthquakes and tsunamis), and extreme biological events (e.g., harmful algal blooms, nonindigenous species, and hypoxia).

Although the annual costs of natural disasters are highly variable, over the last few years weather-related natural disasters alone have taken lives, damaged property and produced other costs averaging at least $50 billion per year or roughly $1 billion per week. The cost of damages from these weather-related disasters (in constant dollars, see figure) has doubled or tripled each decade over the last 35 years. The reported costs are just a fraction of the actual costs that include damages to natural resources, losses of landfill capacity, losses of wages and productivity, and threats to public health. These trends are of great concern to government agencies, the private sector and the public.



For FY99, the Department of Commerce (DoC) has proposed The Natural Disaster Reduction Initiative (NDRI), an inter-bureau effort designed to reduce and mitigate the direct and indirect costs of these natural disasters.

Emphasis is in two critical areas:

- *Moving out of Harm's Way:* Improved warnings and forecasts for protecting people and property from the immediate threat of natural hazards. A strong focus will be on supporting and upgrading operational systems and improving predictions critical to obtaining, forecasting, and communicating information prior to and during hazardous events. This will help to improve lead times and accuracy's of warnings and forecasts to enable individuals, emergency managers, businesses, and entire communities to better prepare and respond to extreme events.

- *Keeping out of Harm's Way*: New information for the private and public sectors of society to ensure that people and property are either not in the path of natural hazards in the first place or are more resilient to them when they occur. It is planed to work with federal, state, and industry partners to identify areas of high hazard risk, develop techniques for mitigating hazard impacts, and improve local and state capabilities to prevent disasters from occurring.

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In FY2000 and beyond, the emphasis would shift from operational warnings and forecasts of immediate events to longer range forecasts of seasonal to interannual climate variability and urgently needed research and education/outreach efforts for a wide range of hazards.

Insured Catastrophic Losses for 1997 Were Lowest in Decade

Summarized by Michael P. Gaus

According to the Property Claim Service Division of the American Insurance Services Group the year 1997 had the lowest frequency and associated property losses for catastrophic events in the last decade. The year 1997 involved 25 catastrophes which caused $2.6 Billion of insured damage claims as compared to 41 catastrophes and $7.4 Billion in insured losses in 1996. Insured property damage was the lowest since 1988 and was the first year since 1990 without a $1 Billion catastrophe. Under insurance criteria a catastrophic event is one which results in at least $25.0 million in insured property loss.

The largest loss in 1997 was due to wind, hail, tornadoes and flood and totaled $300 million across a region extending from Arkansas to West Virginia. The second highest loss was $225 million resulting from flooding in South Dakota.

In the eastern part of the country a total of 36 sates were affected by at least one catastrophe. States suffering the largest losses were South Dakota, Illinois, Minnesota, Texas, New York and Ohio. An important factor in the reduced losses for 1997 was below normal hurricane activity The table below summarizes catastrophe activity since 1982.

Year	# Of Catastrophes	Estimated Insurance Payments ($ Billions)
1982	33	1.5
1983	33	2.3
1984	26	1.6
1985	34	2.8
1986	26	.9
1987	24	.9
1988	32	1.4
1989	34	7.6
1990	32	2.8
1991	36	4.7
1992	36	23.0
1993	36	5.6
1994	38	17.0
1995	34	8.3
1996	41	7.4
1997	25	2.6

The above figures are for insured property losses only and do not include uninsured losses to private property, publicly owned property and utilities, agriculture, aircraft and many other sources of losses including social and economic disruption and long-term recovery losses. Thus the total losses due to wind and other catastrophic events is many times the figures given in the table above.

The 1997 UJNR Meeting

Extracted from a UJNR summary prepared by: Noel Raufaste of NIST

The US-Japan Committee on Natural Resources (UJNR) includes a subcommittee on natural disasters which holds a meeting each year. The secretariat of the US committee is administrated by the National Institute of Standards and Technology. The primary participants in the meeting are representatives of government agencies who present technical papers on natural disaster research and applications. The meeting is hosted by each country in alternate years. The 1997 meeting was held in Japan. An excellent summary of the meeting is available as a web page at: www.bfrl.nist.gov/info/ujnr/triprept.html. The following descriptions which should be of interest to wind engineers were extracted from this summary.

Shinjuku Park Tower Building. The Shinjuku Park Tower constructed by Kajima (http://www.kajima.co.jp/), Shimizu (http://www.shimz.co.jp/english/index.html), and Taisai (http://www.taisei.co.jp/) Corporations is an interconnected three building steel frame structure owned by Tokyo Gas Urban Development Company. Located in Nishi-Shinjuku, Tokyo the 264,000 m^2 building complex houses the Park Hyatt Tokyo Hotel, shops, restaurants, offices, and parking facilities. Its southernmost tower is *235* m high *(52* stories above ground). Its floor plan is such that the narrow section of the building is in the east-west direction. Strongest winds at this site are in the north-south direction. The first three periods of vibration of the undamped system were estimated to be *5.2* seconds in the transverse direction; *4.5* seconds (longitudinal) and 4.0 seconds (torsional). Because the Park Hyatt Hotel occupies the upper portion of the southern tower, serviceability under wind conditions was an important design consideration. To mitigate the effects of wind-induced vibration, the southern tower is equipped with three-unit V-shaped hybrid tuned mass dampers (TMD), called the Trigon System designed by Kajima Corporation.

The Trigon System combines a passive tuned mass damper with active control operated by a *75* kW capacity electric motor. This compact TMD system has adjustable V-shaped rails which slide on rollers allowing for an easy tuning of the period. The three units were installed on the 39th floor off the southern tower rather than the 52nd floor due to space constraints imposed by the Park Hyatt. The TMD is aligned to control transverse vibrations. The moving mass is placed in the center of the triple nested frame. They are suspended by wire ropes. The height of the TMD is about 3 m, to fit into the floor height.

Each unit of the mass damper system has an auxiliary mass of 110 tons, totaling 330 tons which is *0.25* percent of the total building weight above ground. The range of the adjustable natural period is 3.7 to 5.8 seconds. The active control system becomes operational when accelerometers and sensors for wind or earthquake shows the building motion has exceeded a predetermined threshold value. Sensors are installed at the 39th floor; a seismograph is on the first floor. According to Takenaka, et. al (1994), the units can reduce building acceleration by over 50 percent. The Kajima Corporation literature indicates the Trigon System is one of many hybrid mass damper systems under development.

The building's damping is related to the Japanese Standard of Comfort.

References:

[1] Y. Takenaka, et. al. (1994), *Development and Application of V-Shaped Hybrid Mass Damper for HighRise Buildings* and *Proceedings of the 2nd International Conference on Motion and Vibration Control, Yokohama,* August 30- September 3,1994, pp. *563-568.*

[2] Kajima Corporation Technical Pamphlet 93-80E, *Trigon: Weight Driven Hybrid Seismic Response Control System.*

Landmark Tower

(http://www.city.yokohama.jp/yhspot/tower-e.html). The Landmark Tower is a 70-story building in the 'Minato-Mirai' (future port area) along the water front in central Yokohama. It is a redeveloped site. The Landmark Tower is 296 m high, the tallest building in Japan. The building features a five-story atrium for shopping, offices, and a hotel. It is constructed of a hybrid steel reinforced concrete frame from the basement to the 8th floor and of a high strength steel frame structure from the 9th to the 70th floor. The foundation consists of 24,000 m3 of concrete is 24 m below grade.

The exterior of the Landmark Tower is a precast concrete panel wall. Its floor area is about 400,000 **in^2** 1-1/2 times larger than that of the Empire State Building.

The building incorporates a multi-layer pendulum vibration control system that reduces building sway by about 65 percent. The system includes two tuned active dampers (TAD) of 250,000 kg each at diagonal corners of the Tower. They are the largest in Japan. They are on the first floor of the penthouse, 282 meters above the ground. There are only five other buildings in Japan using TAD. The specifications for the tuned active damper system used in the landmark tower is shown in the table.

Number of Units	2 Units
Dimension	9 m(width) x 9 m(depth) x 5 m(height)
Gross Weight	250,000 kg (one unit)
Moving mass weight	170,000 kg (one unit)
Maximum amplitude	±1.7 m
Maximum control force	400,000 N (each direction)
Adjustable natural period	4.3 to 6.0 seconds

A multi-step pendulum concept was used in the design of the TAD to reduce the height requirement. For the Landmark Tower application a three-step design was used which reduced the total height requirement to less than five meters. This allowed the use of only one floor height to accommodate the TAD system. A single TAD pendulum system required about nine m height.

Because of its height and the severity of winds in the Yokohama area the governing design forces for the Landmark Tower are determined by wind rather than seismic loading. The TAD system is designed to counter vibration conditions by moving mass forces in either a passive or active control operational mode. In the active control mode electric servo motors move the TAD system to achieve maximum structural vibration control. Full-scale free vibration experiments evaluated the effectiveness of the TAD system. The damping factor ranged from 0.8% with no control, to 2.4% with passive control, to 10.6% with active control.

The Landmark Tower is a fully integrated structural and operation system taking into consideration efficiency, confidence, and safety of the building's occupants. Each floor is divided into separate fire compartments to direct smoke and gases to wall vents then to the outside. Fire proof shutters are installed in the shopping area to compartment smoke in case of fire. Extensive computer simulations were performed during the design phase to mitigate against wind, earthquakes, and smoke. After completion of the building, full scale smoke tests were performed to verify the design.

Meetings of Interest Calendar

March 1-3, 1998
Kobe, Japan
International Seminar on Long-Span Bridge Aerodynamics
International Conference Center

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FAX +81-45-331-1707
e-mail isbap@cvg.ynu.ac.jp
http://www.cvg.ynu.ac.jp/isbap/index.html

May 11-13. 1999.
Lyngby
Denmark
International Symposium Adyances in Bridge Aerodynamics. Ship Collision Analysis Operation and Maintenance
Contact MiaCon. Meeting and Conference Services
Helsingevoj 23, DK-2830 Viruzn, *Denmark*
Phone: *45 45 85 97 27
Fax: +45 45 83 97 27
E-mail miscon@post8.tele.dk

May 25- 29, 1998.
Gramado RS,
Brazil
Jubileum Conference on Wind effects on Building and Structures
Contact Prof. Jorge D. Riera or Prof. Acir M. Loredo-Souza
LAC/LDEC/CPGEC/UFRGS
C. P. 303 Agencia Central
90001-970-Porto Alegro - RS BRAZIL
Phone: + 55 51 316-3591 or 316-3525
Fax +55 51 316-3999
E-mail : menezes@ darwin.cesup.ufrgs br

June 28."July 1. 1998.
Kyoto, Japan
2nd World Conference on Structural Control (2WCSC)
Contact 2WCSC. Steering Committee
C/o Prof. Akira Nishitani
Dept. of Architecture. Waseda University
3-4-1 Okubo, Shinjuku-ku, Tokyo 169, JAPAN
Phone & Fax; O3-5286-3286
E-mail: 2wcsc@nstn.arch.waseda.ac.jp

July 1998
Nantes, France
International Meeting on Designing with Wind and Climate
Wind and climate engineering: Industrial needs and scientific answers
Contact Dr. Jacques Gandemer
C. S. T. B.
Establissement da Nantes
Service Aerodynamique at Envlronnement Climatique

August 24-26, 1998
Hayama, Kanagawa
Japan
International Workshop on "CFD for Wind Climate In Cities"
Chaired by Prof. Shuzo Murakami
Institute of Industrial Science
University of Tokyo
Contact Dr. Kunio Fujii (General Secretary)

Wind Englneering Institute
3-29 Kanda-Jinbo-cho
Chiyoda-ku,
Tokyo 101
Japan
Phone: +81-3-8287-2811
Fax: *81-3-3237-2812
E-mail: fujii@ba2.so-nat. or.jp

August 31-September 4, 1998.
Kobe. Japan
International Symposium on Long-Span and High-Rise Structures
Organized by: International Association for Bridge and Sructural Engineering (IABSE)
Contact IABSE ETH Hoggenberg CH-8083
Zurich, SwitZerland
Phone; +41-1-633-2647
Fax: +41-1-371-2131
E-mail: secretariat@iabse.ethz.ch

September 7-12, 1998.
Prague. Czech Republic
East European Conference on Wind Engineering "EECWE 98"
Chaired by Prof, Miros Pirner
Acadamy of Science of the Czech Republic
Institute of Theoretical and Applied Mechanics

June 21-24, 1999
Copenhagen. Denmark
Tenth international Conference on Wind Engineering (10ICWE)
Chaired by Prof. Aage Damagard
Danish Maritime Institute
Contact 10t International Conference on Wind Engineering
Danish Maritime Institute
Hjortekmeravej 99
DK-2800 Lyngby, Denmark
Phone: +45 45 87 93 25
Fax +46 46 87 93 33
E-mail : icwe99@danmar.dk
www.danmar.dk/icwe99

Year 2000
Bochum, Germany
Fourth International Colloquium on Bluff Body Aerodynamics and Its Applications (BBAA IV)
Chaired by Prof. H. -I. Niemann

Year 2001
Kyoto, Japan
Fifth Asia- Pacific Symposium on Wind Engineering (APSOWE V)

American Association for Wind Engineering

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Stamp

Interesting Web Links

The following is a sampling of wind engineering web links for those who like to surf the web.

AAWE
rongo.ce.jhu.edu/aawe/
State University of NY at Buffalo
www.civil.buffalo.edu/wind/windhp.html
University of Notre Dame
www.nd.edu/~nathaz
National Hurricane Center
www.nhc.noaa.gov/index.html
Texas Tech University
www.ce.ttu.edu/wind/main.html
Clemson University
champ.eng.clemson edu/
University of Western Ontario
http://blow.blwtl.uwo.ca/blowtlhom.html
Japan Assoc. for Wind Engineering
www.soc.nacsis.ac.jp/index.html
Dutch Full-Scale Experiment
hercules.bko.bwk.tue.nl/~phydas