



American Association
for Wind Engineering

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THE WIND ENGINEER

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Special Points of Interest:

- Over 1200 tornadoes were reported in U.S. in 1999
- Nine tornadoes hit U.S. metropolitan areas since 1997
- Hearing on tornadoes held by two subcommittees of U.S. House of Representatives
- FEMA announces recommendations to reduce damage due to tornadoes
- Tribute to Richard Marshall acknowledges his unmatched insight and warm personality
- Cable Aerodynamics Committee meets during 10th ICWE in Copenhagen
- Participation of AAWE members in promotion of AAWE is sought
- Readers are encouraged to submit to the Editor materials for inclusion in future issues of *The Wind Engineer*
- The previous issues of *The Wind Engineer* are now available on line, at the AAWE web site.

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Tornadoes and Tornado-Related Activities of 1999 and 2000

Fort Worth/Arlington Tornadoes

On March 28, 2000, at 5:33 p.m., the National Weather Service (NWS) Forecast Office issued a severe thunderstorm warning for Tarrant County, Texas, and upgraded it to a tornado warning at 6:10 p.m. CST, ten minutes before the tornado touchdown in the western section of downtown Fort Worth and 50 minutes before hitting the city of Arlington.

The aftermath of the two tornadoes resulted in over 370 homes in just one community destroyed or damaged and a number of prominent office buildings in downtown Fort Worth with severely damaged glass and curtain walls. Some of the buildings looked like skeletons with almost every window blown out. Life loss and injuries were minimized due to the fact that the tornado struck shortly after normal business closing hours. Downtown Fort Worth faced a dangerous situation after the tornado due to falling glass. Quoting Police Chief Ralph Mendoza "It's a very dangerous situation with the potential of 200-pound panes of glass coming plummeting down from 35 floors high".

In one neighborhood recently constructed homes in the \$200,000 range which were recently constructed were severely damaged. This may raise

questions concerning the reliance on current building codes to provide acceptable performance. Although controversial, perhaps this issue would benefit from additional technical-economic review.

Tornadoes of 1999

In its 1999 annual summary, NOAA reported over 1200 tornadoes in the U.S. They included six major outbreaks. Half of them occurred at unusual times of the year, January and December. The total was 200 fewer than over 1400 tornadoes reported in 1998. Ninety-four deaths were attributed to 29 killer tornadoes. Tornadoes struck four major cities: Little Rock, Ark., Cincinnati, Ohio, Oklahoma City, Oklahoma, and Salt Lake City, Utah.

The 1999 year began with a tornado outbreak on January 1 and 2, with 26 tornadoes observed in Texas and Louisiana, and one fatality. On 17 January, 25 tornadoes killed eight people in Arkansas, Tennessee, and Missouri. Four days later, six people died as 104 tornadoes struck Arkansas, Louisiana, and Tennessee, on January 21 and 22. Overall 216 tornadoes was reported in January 1999, more than quadrupling the previous record of 50 tornadoes, reported in January

1997.

On April 5, an F4 tornado hit the Cincinnati area. It was part of an outbreak of 70 twisters that began the evening before and tracked across Nebraska, Iowa, Missouri, Illinois, Indiana, and Ohio.

In May, 325 significant tornadoes were reported. It was the highest monthly total for the whole 1999. The most expensive tornado outbreak in U.S. history and the deadliest of the year occurred on May 3 and 4, in Oklahoma and Kansas. In less than 21 hours, 78 tornadoes touched down across the two states with as many as four tornadoes from different storms on the ground at once. An F-5 tornado, the strongest on the Fujita scale, moved along a 38-mile path from Chickasha through south Oklahoma City and the suburbs of Bridge Creek, Newcastle, Moore, Midwest City, and Del City. With 8000 buildings damaged, the Oklahoma City tornado is the most expensive single tornado in history. The tornadoes killed 46 people, injured 800, and caused \$1.5 billion in damage.

The June total of significant tornadoes was 275 and it was the second largest monthly total of 1999. On July 24, three people were killed when a tornado caused a tree to fall on a car in Cleveland.

A rare tornado in Salt Lake City on August 11 killed one person. On September 4 and 16, tropical storms Dennis and Floyd caused small tornado outbreaks in Virginia and North Carolina.

Tornado outbreaks also occurred in the cool season of 1999. On December 2, six twisters killed two people in Chico, Texas, and an F-3 tornado moved on December 9 through Benton, Mississippi.

Overall, the 1999 total number of tornadoes was the fourth highest in the period 1950 through 1999.

(Additional information the 1999 and 2000 tornadoes can be found at <http://www.spc.noaa.gov>)

25th Anniversary of U.S. Largest Outbreak

On March 31, 1999, the NWS commemorated the 25th anniversary of the nation's worst tornado outbreak, which took place on April 3 and 4, 1974.

During the 1974 outbreak, tornadoes caused a damage path of more than 2500 miles leaving 330 dead and 5484 injured. In less than 24 hours, twisters ran the gamut from 0 to 5 on the Fujita Scale, with some tornadoes traveling more than 100 miles. One twister was five miles wide and at one point, 15 tornadoes were on the ground at the same time.

In all, 13 states were struck by twisters: Alabama, Georgia, Illinois, Indiana, Kentucky, Michigan, Mississippi, North Carolina, Ohio, South Carolina, Tennessee, Virginia, and West Virginia

Congressional Testimony on Tornadoes

A two-hour hearing was jointly held on June 16, 1999, by the House Science Committee's Subcommittee on Energy and Environment and the Subcommittee on Basic Research. Four tornado researchers—Rr. H. Bluestein (Univ. of Oklahoma), D. McCarthy (NWS Norman, Oklahoma), Dr. R. Wakimoto (Univ. of California at LA), and Dr. M. Weisman (Nat. Center for Atm. Res.) - and they covered a wide range of tornado-related topics. These included: progress in tornado warnings, instrumentation for field measurements, requirements for computational power (100 times the currently available power) needed for improvements in nationwide numerically-aided weather forecasting, and others.

They also reviewed research progress made in study of storms, particularly the use of mobile systems such as Doppler on Wheels, Mesonet (a network of automated surface weather stations), instrumented cars, and TOTO (Torable Tornado Observation), designed to be placed in the path of tornadoes.

The speakers reiterated that the U.S. is the most weather hazard prone nation on the Earth and that, although significant progress has been achieved in dealing with extreme winds, more research is needed. Better science and generated knowledge will lead to better operational procedures, to anticipate, predict, and warn for tornadoes and other extreme weather phenomena, and to develop more effective wind hazard reduction.

Postscript

Since 1997, at least nine tornadoes affected major metropolitan areas: Miami Fla. (May 12, 1997), Birmingham, Ala. (April 8, 1998), Nashville, Tenn. (April 16, 1998), Little Rock, Ark. (January 21, 1999), Cincinnati, Ohio (April 9, 1999), Oklahoma City, Okla. (May 3, 1999), Salt Lake City, Utah (August 11, 1999), Milwaukee, Wis. (March 8, 2000), and Fort Worth, Tex. (March 28, 2000). A high level of damage to engineered structures (such as office, retail and manufacturing facilities) had been reported in such instances. A potential for a

significantly higher material and human toll in such cases exists. Past and on-going effort addressing mitigation of tornado effects has been primarily focused on residential houses and manufactured homes, mainly in suburban areas. It appears that this effort should be broadened to include investigations of impact and mitigation of tornado effects on engineered structures in urban setting.

FEMA Director Announces Recommendations for Reducing Tornado Damage

On March 28, 2000, Federal Emergency Management Agency (FEMA) Director J. L. Witt announced recommendations for homeowners, businesses, and communities, to reduce damage due to high winds associated with tornadoes.

A summary of the FEMA recommendations and a full text and video of Director Witt presentation can be found on the FEMA web site <http://www.fema.gov>

Tribute to Richard Marshall

As we reported in March issue of the Wind Engineer, Richard D. Marshall (Ph.D., CSU, CE Dep., 1968) passed away on February 24th, after a long illness.

Dick received his B. S. degree in Civil Engineering from North Dakota State University (1956), his M. S. degree in Civil Engineering from the University of Colorado (1959), and his Ph. D. from Colorado State University (1968).

He was associated with the National Institute of Standards and Technology since 1968 through his retirement in 1996. There, he directed research activities concerned with the wind effects on buildings and structures, and served as leader of the Structural Engineering Group and the Structural Evaluation Group. Prior to joining NIST, Dick was associated with Colorado State University's Fluid Dynamics and Diffusion Laboratory (now Wind Engineering and Fluids Laboratory), where he was involved in wind tunnel studies of several tall buildings, including the New York City World Trade Center and the Bank of America World Headquarters Building in San Francisco.

Dick received the Department of Commerce Silver (1975) and Gold (1982) Medal Awards, and the National Hurricane Conference Engineering

Award (1991). In 1999, he was the first recipient of the Walter P. Moore Jr. Award of the ASCE Structural Engineering Institute, established to recognize technical excellence in and dedication to development of structural engineering codes and standards. The award was made to Dick in recognition of his many contributions to the development of ASCE-7 Standard on Minimum Design Loads for Buildings and Other Structures.

Dick made numerous contributions to the area of wind and structural engineering. His unmatched insight into analyzed problems and warm personality will remain in our memory for ever.

A Wind Engineering Library in name of Dr. Richard Marshall is being established at the Wind Engineering and Fluids Laboratory, Colorado State University. Donations to support this initiative should be forwarded to: CSU Foundation, Wind Engineering Library, College of Engineering, Fort Collins, CO 80523.

Web site for 11th ICWE Meeting

April MacDowell from the Texas Tech Wind Engineering Research Center has announced the establishment of a web site for the 11th International Conference on Wind Engineering which will be hosted by Texas Tech University. The web site can be accessed at <http://www.icwe.ttu.edu>. This is a new site and information will be continually added as plans and arrangements develop.

April has also created pages to provide information on news releases and links to code organizations. You can find these at www.wind.ttu.edu/news_publicity.htm and www.wind.ttu.edu/organizations.htm.

Minimum Design Loads for Buildings and other Structures, ASCE 7-98

The latest revision of the ASCE Standard Minimum Design Loads for Buildings and Other Structures is now available in complete form. This Standard, a replacement for ASCE 7-95, contains new material including an expanded wind load section, new requirements for flood and ice loads, and improved requirements for snow and earthquake loads. Also included is a detailed commentary on the standard. Architects, structural engineers and those engaged in preparing and administering local

building codes will find the structural load requirements provided by this standard essential. An interactive, full-text CD ROM version of the standard is also available. The ISBN number is 0-7844-0445-3. The book has 352 pages and can be ordered from the ASCE web site at www.asce.org.



Copenhagen, June, 1999

Minutes of Cable Aerodynamics Meeting 10th ICWE, Copenhagen, Denmark, Tuesday, June 22, 1999, Radisson SAS Scandinavia Hotel, Oslo Room

Objective: Cable aerodynamic vibrations have become more of concern to both bridge and electrical engineers. This meeting aims to exchange up-to-date information on wind-induced vibration of cables and seeks to obtain suggestions for finding more reasonable and reliable vibration control.

1. *The meeting was called to order at 10:30 am by Masaru Matsumoto and Nicholas P. Jones. An attendance list was circulated (attached).*
2. *Report of summary of responses to survey circulated by M. Matsumoto (attached).*
3. *Video presentations: A number of guests presented short videos outlining either field conditions or lab simulation of stay cable vibration. Where available, short descriptions are included below.*

Cables of cable-stayed bridges in Japan (T. Yagi, Japan)

This videotape includes three examples of the wind-induced cable vibration of the cable-stayed bridges in Japan. The first example is the cable-stayed bridge with the main span length 184.2m and it has the single plane cables. The weather condition was rain and the wind speed was about less than 20m/s. The double amplitude of the vibration was 50-60cm. The dampers were installed. The second one is the cable-stayed bridge with the main span length 350m and it has the 2-plane cables. The weather condition was rain and the mean wind speed was about 10m/s. From the observation data, the maximum double amplitude of the vibration is 237cm. The dampers were also installed. The third one is the bridge with the main span length 420m and it has the 2-plane cables with twin cables. The weather condition was rain and the double amplitude was 40-100cm. The wire connection was tried and the spacers were installed. The type of these wind-induced vibrations seems to be the rain and wind induced vibration. The details of these vibrations can be found in a article, which is "Wind-induced cable vibration of cable-stayed bridges in Japan" by M. Matsumoto, K. Yokoyama, T. Miyata, Y. Fujino and H. Yamaguchi in Proceedings of Canada-Japan Workshop on Bridge Aerodynamics, NRCC, Ottawa, Canada, 1989, pp. 101-110.

Stayed cables of Erasmus Bridge (A.J. Persoon, The Netherlands)

In November 1996 the cables of the Erasmus Bridge showed vibrations under rain and windy weather. Although the main span is of a medium size (285 m) the longest stay-cables are around 300 m because this bridge has only one pylon. Water rivulets were observed on the polyethylene casings of the cables. At medium wind speed of around 12 to 16 m/s at 30 degrees with the axes perpendicular to the bridge the cables showed vibrations of .5 to .7m (2 to 3 times the diameter) mostly in the second mode shape.

After consultation with Japanese experts the Public Works of Rotterdam (location of the bridge) proposed to install hydraulic dampers as a countermeasure. The minimum damping coefficient (percentage critical) should be .5% but to avoid any risk .8% should be the lower limit.

Full-scale tests were performed with prototype dampers

to verify the required damping. A number of representative cables were excited by means of a small hydraulic actuator. Using the well-known 90 degrees phase criterion the cables were set into a number of natural frequencies up to three Hertz at sinusoidal excitation. By switching off the excitation decay's were obtained from which the damping factor was estimated. The actual dampers were installed within one year later. Up till now no vibrations of cables (and bridge deck) were reported.

Because of traffic passing the bridge we (NLR) had some problems by adjusting the phase criterion as the cable tension changed and with that the natural frequencies.

So it is advisable to close the bridge when such type of measurements are carrying out.

Cables of Cable-stayed bridges in U.S.A. (P. Sarkar, U.S.A.)

In April 1997, Texas DOT officials recorded this footage showing large-amplitude vibrations of stay-cables at the Veterans Memorial Cable-Stayed Bridge located near Port Arthur, Texas on State Highway 87 (150 km east of Houston). This bridge was opened to traffic in 1991 (main span 191 m; 4 planes of 28 stay-cables arranged in vertical harped-configuration). The stay-cable vibrations were observed at wind speeds below 15 m/s while it was raining. At any one time, a number of adjacent stay-cables were observed to be simultaneously excited.

Texas DOT officials recorded this footage at the Fred Hartman Cable-Stayed Bridge located near La Porte, Texas on US146 (25 km south of Houston). This twin-deck bridge was opened to traffic in 1995 (main span 381 m; 4 planes of cable per deck arranged in fanned configuration). The cable that is observed to vibrate here is the longest among the 24 cables that comprise one plane of stay cables, and hence it has the lowest natural frequency among all the cables (first natural frequency: 0.67 Hz). It was observed to vibrate in the third mode. The winds were gusting up to 22 m/s without the presence of rain. This observation showed that cables can vibrate even without the presence of rain at wind speeds above the range of wind speeds where rain-wind induced vibrations usually occur. The next footage shows rain-wind induced vibration of stay-cables at the Fred Hartman Bridge at wind speeds below 15 m/s in the presence of rain. A set of adjacent cables was observed

to excite simultaneously.

Rain-wind induced vibration of cables (H. Ruscheweyh, Germany)

Video about the oscillation of the water rivulets.

The oscillation of the water rivulets at a cantilevered aeroelastic model (diameter 100 mm, length 2 m) has been observed and documented by a video film (C. Verwiebe). At lower wind speed the model is excited to cross-wind vibrations and the rivulets oscillate asymmetrically in front of the meridian.

By increasing the wind speed the two rivulets are shifted to a position behind the meridian and the model vibrates in a in-wind mode. Both rivulets oscillate symmetrically to and fro.

Hanger ropes cable of Akashi Kaikyo Bridge (H. Katsuchi, Japan)

The video showed an example of wind-induced vibration observed at the hanger cables of the Akashi-Kaikyo Bridge.

In the Akashi-Kaikyo Bridge, polyethylene-covered round hanger cables were used instead of conventional CFRC spiral cables, except of some short-length cables. The length of hanger cables ranges from 26 m to 200 m with a diameter of 87 mm. Since two hanger cables are aligned at one fixing point, wake-galloping was feared to occur at the designing stage. However, it was reported that wake galloping would occur if the distance of two cables ranged from 1.5 to 6 times diameter, and the distance of two hangers of the Akashi-Kaikyo Bridge was set to 9 times diameter. Therefore, non-occurrence of wake-galloping was judged in the Akashi-Kaikyo Bridge.

During construction stage, two kinds of vibration were observed. One is vortex-induced vibration at a low wind speed. The other is unknown large-amplitude vibration. The vibration typically occurred at a wind speed of more than 12 m/s, on 100 - 200m long leeward cables, with in-line vibration with an elliptical orbit. 1st - 7th modes were observed and their amplitude reached 8 times diameter at the maximum.

In order to investigate the mechanisms and countermeasures, wind-tunnel investigation was carried out. A pair of hanger cables of 140m long were modeled as a section model with a natural frequency of 0.71 Hz. A windward cable was fixed and leeward one was supported by

springs. The result showed that vertical movement on the leeward cable dominated at a low wind speed, but lateral movement gradually dominated as wind speed increased. Based on these results, the unknown vibration was identified wake-induced flutter which was often observed on power cables.

Wake-induced flutter occurred at restricted angles of attack in both the full scale and wind-tunnel testing. Finally, winding 2 helical ropes, which effectively reduced the amplitude in the wind-tunnel testing, was adopted as a countermeasure for wake-induced flutter. Countermeasure work is now in progress.

Back-stay bundle of a suspension bridge (E. Hjorth-Hansen, Norway)

Violent response of suspension bridge backstays; Askoy Bridge, Bergen, Norway.

During construction when only main cables and catwalks were in place, the structure was hit by the storm on New Year's day, 1992. The temporary spacers fixing the patent lock-coil main cable members into an open, rectangular bundle disintegrated in the backstay part. So, the individual cable members got free and hit one another with a sound resembling that of advancing cavalry.

After the storm the "wounds" were healed in place by paint etc.

The film taken by Norwegian Public Roads Administration shows a case where any prediction method (wind-tunnel modeling or computational fluid-structure interaction) are likely to fail.

Transmission lines (K. Kimura, Japan)

Galloping of ice-accreted twin bundled conductors overhead line observed at the Tsuruga Test Line of Kansai Electric Power Company in Japan was shown on the video. The span of the line is 234m and the peak to peak amplitude seems to be approximately 1m. The wind speed was probably around 15m/s. The accreted ice was soft rime on the windward side of the conductors and its length was probably around 10 cm.

Because the unsteady aerodynamic force characteristics acting on the conductors while they are vibrating with large amplitude are not known, a series of experiments is now carried out by using a newly designed apparatus that can measure the aerodynamic forces under forced

harmonic vibration with amplitude of +500 mm in vertical and horizontal and +55 deg. In rotational direction.

4. Panel and open discussion

Panelists: G. Diana (Italy), Y. Fujino (Japan), E. Hjorth-Hansen (Norway), P. King (Canada), H. Niemann (Germany), G. Piccardo (Italy), H. Ruscheweyh (Germany), P. Sarkar, (U.S.A.), J. Xie (Canada)

Potential topics suggested included:

- Practical experiences of cable vibrations and damages
- Research works
- Site measurements
- Wind tunnel tests
- Analytical approaches
- Vibration control

A number of the panelists gave short presentations/remarks:

Fujino described recent efforts using active, semi-active, and magnetic damping in a number of applications.

G. Diana noted that considerable investigation into cable dynamics has occurred in the transmission line industry, and that we should ensure links with relevant CIGRE and IEEE working groups. He also noted that damping may not work for wake galloping problems, whereas vibration absorbers may be appropriate for ice-related galloping.

H. Ruscheweyh described a case where vibration absorbers/dampers worked well for rain-induced vibration in near-vertical hangers. Tunable fluid dampers produced considerable reductions in amplitude. (Later discussion generally supported this type of solution for this application.)

P. Sarkar showed and discussed some wind tunnel testing of stay cable sections with simulated rain effects, including a discussion of several aerodynamic mitigation methods.

G. Piccardo described an analytical technique for the nonlinear analysis of galloping cables.

M. Matsumoto asked the questions: 1. Is rain necessary for large-amplitude vibration? 2. Is a log-dec damping of 0.02 as frequently proposed sufficient? Data were showed indicating the presence of beating oscillation

(multiple modes) as well as single mode.

General discussion ensued, with the following points made or issues raised:

Log-dec damping in stays as low as 0.0005 have been measured. (Verwiebe). It was suggested that we focus on three areas: 1. Understanding the mechanics of the phenomenon; 2. Modeling (including field and laboratory experiments); and 3. Mitigation techniques. (Fujino)

The group might provide a forum to share and/or publish information on, for example, the variability of responses and response types, and to share information about cable parameters and characteristics (e.g., frequencies, dampings, mode shapes, wind directions, etc.) (Xie, Cooper, Ruscheweyh, Persoon). Even dissemination of (initially) worst-case data and associated parameters was encouraged (Ruscheweyh). The use of a web site was suggested, with Soren Esdahl volunteering to help in this effort. (Larsen, Jones, Sarkar)

The fact that the cables are part of a large, complex, dynamic system should not be overlooked. (Larose)

What are the critical parameters? (Larsen)

Addition of damping (e.g., by using a Scruton number criterion) was pointed out as a potential solution (Diana, Sarkar)

Performance of damper systems on Erasmus (Persoon) and Huntington (Jones) was reported as successful. Failure of a restrainer system in Texas was reported (Jones). Aerodynamic solutions were raised and discussed (Sarkar, Matsumoto). It was noted that aerodynamic solutions require little maintenance vs. mechanical. It was also noted that on the second Severn bridge, addition of cross ties to mitigate cable vibration led to other (broader) vibration problems. (Larose)

The formation of specific working subgroups was suggested, and need to coordinate with the power line community reiterated. (Diana)

Attention was brought to the upcoming International Conference on Cable Dynamics in mid-August in Trondheim.

5. Closure (N. Jones, M. Matsumoto)

The chairs thanked all the attendees for their participa-

tion, and reiterated that active participation would be needed in the future to assure the success of the working group. Minutes will be distributed in PDF format, and efforts will be made to get the web site up and running as soon as possible.

The meeting was adjourned at 12:30 pm.

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The results of survey are summarized on page 11.

Presidents Corner

The year 2000 storm season is about here and the Bill Gray research team at Colorado State University predicts the coming season will be less active than several recent seasons, but it is expected to be slightly higher than the long term average of nine named storms. The forecast is for 11 named storms with seven becoming hurricanes and a probability of one or more major hurricane with wind velocities above 110 mph making landfall in the U. S. There is no reason to expect that the number of tornadoes and other severe wind events will be significantly less than last year. Thus we can look forward to another year in which large amounts of damage and losses are inflicted on an unsuspecting population. Good for contractors maybe, but not so good for the population. Clearly research is needed to develop the information base needed to reduce losses to new and existing constructed facilities. Some action is underway in Congress with the Wind Hazard Reduction caucus in the House and the Natural Hazards Caucus in the Senate. Good first steps but now we need to do an education job on what needs to be done—assuming we can agree among ourselves. In spite of the meager resources which have been available for wind engineering studies our members from two locations are ready with mobile towers to attempt to capture missing information on the engineering characteristics of hurricane winds, a number of structures along the coasts have been instrumented, some progress is being made in computational wind simulation and additional work is underway on storm shelters just to mention a few of the activities underway. We need your input regarding research priorities, ways to improve technology transfer and implementation, and things AAWE could possibly do. Let us hear from you.

AMERICAN ASSOCIATION FOR WIND ENGINEERING

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

Dr. Partha Sarkar, Aerospace Engr. & Engr. Mechanics, 2271 Howe Hall, Room 1200, Iowa State University, Ames, IA 50011-2271

Name: _____

Title: _____

Affiliation _____

City _____ State/Zip _____

Country _____

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E-mail _____

Your Wind Engineering Interests _____

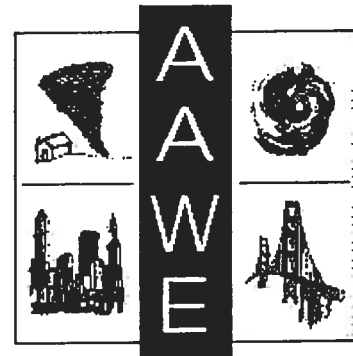
AMERICAN ASSOCIATION FOR WIND ENGINEERING

www.civil.buffalo.edu/aawe

E-mail: gaus@engr.buffalo.edu

Tel: 716-645-2114 x-2410

Fax: 716-645-3733



**American Association
for Wind Engineering**

OBJECTIVES

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

CURRENT OFFICERS

President: M. Gaus (Univ. of Buffalo)

Vice President: B. Bienkiewicz (Colorado State Univ.)

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WHY YOU SHOULD JOIN:

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

HOW TO JOIN

Fill-in the Membership Application Form and forward it to AAWE Secretary/Treasurer. For more information visit AAWE web site or contact Mike Gaus (gaus@eng.buffalo.edu, 716-645-2114 x-2410, voice) or Bo Bienkiewicz (bogusz@engr.colostate.edu, 970-491-8232, voice).

Get involved in formulating
National Wind Hazard Reduction Program

Please Post

Wind-Induced Cable Vibration in Various Countries

Country Name; Type of Vib.; Monitoring; Climate Condition; Type of Bridge (Span); Surface; Site Condition; Countermeasure; Publish; Activity

Belgium; J.L. Lilien; K,RV, WG, IceG; anemo, 1); 8-13m/s, 2); CSB(250), OHL (40-500); PE, 3); inland river, 4); damper, wire, 5); yes; active

Denmark; A. Larsen; K, RV, WG; anemo/acceler; 8-10m/s, rainy 6); CSB(300), SB(1600); PE; river mouth, sea; wire; no; going to be active

Germany; H. Ruscheweyh; RV; 8m/s, rainy; CSB(300), NAB(100); non; inland river; damper, wire; yes; less active

Italy; G. Diana; K, RV, WG; anemo/accelero; 10m/s, rainy; SB(1400); 7); river mouse; damper; yes; active

Italy; G. Solari;

Norway; E. Hjorth-Hanses; ; active

Poland; A. Flaga; K, WG; up to 20m/s; CSB(100), SB(100) 8); non inland river; ; yes; going to be active

U.K.; T.A. Wyatt; RV; ; 15m/s, rainy; CSB(450); PE; sea; wire; no; less active

U.S.A. ; N. P. Jones; P. K,RV,NR; anemo/accelero; up to 25m/s, various; CSB(300,400); PE; inland river; river mouse; damper, wire; yes; active

Canada & U.S.A; P. A. Irwin; R,RV,NR; anemo/accelero; 7-20m/s, rain & no rain; CSB(200-500); PE; inland river, river mouse; damper, wire; yes; active

Australia; J.D. Holmes; RV; 15-20m/s, rainy; CSB(345); PE; urban area; temporary ropes; no; less active

- 1) Tension recording for overhead line
- 2) K: fine or snowy, RV: obvious, G: windy or/and icy
- 3) OHL: Type of conductor (aluminum in surface, stranded)
- 4) K: no turbulence region, enlarged if snow deposit, G: no obstacles but can be turbulent
- 5) "Special materials" used inside stays to increase damping up to 18%
- 6) Wake Galloping was observed during clear weather for vertical hangers
- 7) Painted Steel
- 8) Mainly cable stayed and suspension light steel foot bridges with span length up to 100m



National Weather Service Photo, Arlington, TX
March 29, 2000

From the Editor

Contributions to this Newsletter

B. Bienkiewicz, *Tornadoes in 1999 and 2000*

S. Sunder, *Tribute to R. Marshall*

N. Jones, *Minutes of Cable Aerodynamics Mtg.*

We strongly encourage all the members of AAWE to submit to the Editor materials suitable for inclusion in *The Wind Engineer*. Please forward your contributions, questions or comments to bogusz@enr.colostate.edu, or call 970-491-8232, 970-491-8200 fax.

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Dr. Ahsan Kareem, Past President
University of Notre Dame



**American Association
for Wind Engineering**

Established 1966

Objectives:

The advancement of science
and practice of wind engineer-
ing

The solution of national wind
engineering problems

Please help us promote AAWE. Cut out, copy and distrib-
ute among your associates and friends, and post the mini
poster / membership application form included with this
Newsletter, pages 9 and 10. Thank you in advance for
your assistance.

Please Note:

In order to try to put AAWE on a more businesslike basis it
was decided that the membership year would extend from July 1 to
June 30 of the following year. We inadvertently put the period Aug
1, 1999 to July 31, 2000 on the membership cards for last year. The
correct period will appear on 2000-2001 membership cards

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