



American Association
for Wind Engineering

THE WIND

ENGINEER

NEWSLETTER OF AMERICAN ASSOCIATION FOR WIND ENGINEERING

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Photo: Adrian Pingstone, in the public domain

OUT OF STEP ON THE BRIDGE: REVISITING THE SAGA OF A ONCE WOBBLY BRIDGE

By **AHSAN KAREEM**

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Ever since the news concerning the wobbling of the Millennium Bridge in London surfaced, I have been intrigued like many others, e.g., those reported in the recent write-up in the Civil Engineering News section of the Civil Engineering (Biomechanics Research Yields Clues to Millennium Bridge Wobble, May 2009). Since then it appears that the cause of the problem has been pinpointed and the designers have arrived at appropriate solutions based on their findings from tests involving mechanical shakers and laboratory studies of individuals balancing themselves on wobbly footings. These also concur with the findings of other researchers as noted in the Civil Engineering News. I am writing this to acknowledge the observations chronicled in London's Guardian by a reader just two days after the opening of the bridge, when the wobbling of the bridge resulted in its

closure, and well before any studies had been conducted. Remarkably, he arrived at the correct explanation which deserves to be acknowledged in the structural engineering community. This letter will serve as my appreciation of the confident mix of scientific insight and understanding reflected in the following short note.

The letter was written on June 14, 2000 in the Guardian. It is reproduced here: "The Millennium Bridge problem (Millennium Bug Strikes Again, June 13) has little to do with crowds walking in steps. It is connected with what people do as they try to maintain balance if the surface on which they are walking starts to move, and is similar to what can happen if a number of people stand up at the same time in a small boat. It is possible in both cases that the movements that people make as they try maintain their balance lead to an increase in wherever swaying is already present, so that the swaying goes on getting worse.

Is it true that "the bridge is never going to fall down," or at any rate get damaged, as a result of the swaying? That has been said about bridges before, and those responsible for this one need to understand, before making such

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pronouncements, that the problem involves more than engineering principles. Prof. Brian Josephson Department of Physics University of Cambridge”

Professor Josephson received the Nobel Prize in 1973, at age 33. I came across this thoughtful observation while reading Steven Strogatz's book SYNC - The Emerging Science of Spontaneous Order. Strogatz has eloquently drawn parallels between other oscillators of different origins, e.g., electronics, pendulums, high-tech devices and people with similar synchronization behavior. Simply put, as the bridge swayed the pedestrians on the bridge unconsciously adjusted their pace that matched the bridge's lateral movement. The situation further deteriorated, which led to more people getting off balance and in an attempt

to regain their equilibrium reinforced their synchrony and further exacerbated bridge motion. This may be viewed as humans acting as active actuators or serving as a source of positive feedback between the pedestrians/humans and the bridge, a fact not taken into consideration by any design code thus far! Though similar positive feedbacks in structural engineering between fluids and structures are well studied and captured in design practice like flutter of bridges and drifts of floating offshore systems. A new course for seniors at Notre Dame is being taught by the writer this fall that addresses some of the intriguing motion-related issues in structural engineering, entitled, “Analysis of Wobbly Structures: An Introduction to Structural Dynamics,” where the wobbly bridge serves as the central theme of discussion!



WIND ENGINEERING PARAMETERS BECOME DYNAMIC WEB TOOLS

BY FRANK L. BENNARDO

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This tool to digitize complex engineering calculations into rich, easy to use FLASH files isn't exactly new. Engineering Express has been at it since 2005, but it is something that is unfamiliar to many.

"I'm amazed that this technology is not in the mainstream by now" claims Frank Bennardo, P.E., founder of the firm and of this connection between engineering formulas and FLASH programming. Well, that hasn't happened and he's been at it ever since he had the brainstorm to connect the two to bring this vision to reality. It appears that all that was needed were a few missing pieces which were recently uncovered by watching how WIDGETS are progressing on mainstream websites.

As Frank further explains, "I was amazed at how easy it was to use a WIDGET, copy the code to wherever I needed it, and access the data. Then I searched for engineering WIDGETS and all I could find was a calculator and unit converter". And so the missing puzzle piece was put into place, adopting their honed system of creating large and complicated online FLASH calculators into smaller, portable WIDGETS. "That was the missing piece of technology that puts this all together and creates a platform that can propel this need into the mainstream for almost anyone".

In a nutshell, Engineering Express has found a very clean and adaptable way to take table or chart data and convert the inputs to dials, sliders, and animation that can show in real time not only the answer, but iterations in between the table answers. These WIDGETS also make possible reverse questions where you may know the answer but not the question. By sliding a dial or slider and watching the real time answers, you can find the 'sweet spot'-the perfect design. They do thousands of calculations in seconds what is unlikely to ever be done by hand. A WIDGET can also contain many tables in one, and can be programmed to show further

solutions beyond the table, even in picture and video format. Gone are the wasteful days of grossly over-designing a component because finding the right answer takes more time and costs more than it's worth.

These WIDGETS go far beyond 'geeky' calculations that will inevitably change the worlds of engineers, architects, and contractors. They are able to help answer many of the questions the general public would ask at a Lowe's or Home Depot, for example. Imagine a touch screen kiosk at your disposal in 'isle 7' instantly answering questions like how many boxes of flooring to buy for a given area, while also telling you the cost, waste factor, how much glue to buy, and perhaps even offering a discount coupon or informing you of the perfect wood stain to go with the product. Take the idea into the plumbing department, electrical department, wood section and carpeting and drapes, and you have a whole new generation of questions and answers that can save manufacturers (and the retail stores) millions of dollars and generate completely new revenue streams in line with the visions of the future of economics.

Engineering Express has also figured out how to offer the embed code for their WIDGETS and even allow you to post them to your iGoogle page in a single click (Don't have one of those yet? Get with it!). This means that you can mash up just the WIDGETS you need. Say you are a glass company. You could put a Weight of Glass WIDGET, a Wind Pressure Design WIDGET, Aluminum Tube Mullion Check WIDGET, and a Weld Check WIDGET all on a tab in iGoogle, and make them accessible to you anywhere, anytime, maybe also post them to your FaceBook Wall, or put them on your company website to help your customers get answers easier and help better select your products.

It is Engineering Express's hopes that every company that publishes a chart or table will call on them (like Powers Fasteners did to put nearly an entire catalog into one FLASH tool) to convert their data. They say the time has come that every lumber, bar joist, brick selection, strap connector, window or door size selection chart, and hundreds of other uses be freed from their archaic chains of hardcopy paper and static PDF downloads and offered this wonderland of new possibilities to roam.

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They already have over 30 free widgets and tools to choose from and growing fast, found on their website at <http://www.engexp.com/exos/widgets.cfm> and even a YouTube Video Channel to help explain the concept and individual use (search for 'Engineering Express' in YouTube or find it on their website). They also have aggressive, Google-like business models to make this technology available to even the most struggling of companies in this economy. "These WIDGETS will quickly help your business by attracting new customers, allow better existing customer retention, and help you go from inquiry to closing a sale much more quickly, and we're willing to ride that curve with you" states Frank. Their organic growth of this technology affords them much leeway and allows them to invest in the future, a rare find in these trying times.

Already gaining interest among the Product Approval Industry and being looked at by building codes to replace static age-old charts and tables, Engineering Express may be a company to watch in 2010. Visit them online at <http://www.engexp.com> and while you're there, take notice of their Online Plan Store, a free Industry Knowledge Base.

ASCE 7-05 Pressure Calculator		ASCE 7-05 Rooftop Equipment Wind Load Calculator		ENGINEERING EXPRESS® Roof Over Open Structure	
ENTER Building Mean Roof Height 15.00 ft.	Basic Wind Speed: 140 MPH Bldg. Classification: Enclosed Exposure: C Bldg. Category: II Zone: 4 Roof Type: Gable Roof Slope: 18.4 Deg Wind Directionality Factor, Kd: 0.85	ENTER Building Mean Roof Height 15.0 ft	Basic Wind Speed: 140 MPH Importance Factor: I Exposure: C	ENTER Mean Roof Height 15.0 ft	Basic Wind Speed: 140 Mph Exposure: C Zone: 3 Roof Slope: 0.0° Bldg. Category: III Wind Flow: Clear Directionality Factor, Kd: 0.85 Effective Wind Area (C&C): 12.00 ft²
Opening Size: Height: 48.00" Adjusted Area: 10.00 sq.ft. Width: 30.00"	Shape of AC Unit <input checked="" type="radio"/> Square <input type="radio"/> Round <input type="radio"/> Hex/Oct Width: 24.0 in Height: 42.0 in Wind Direction: Face	Loading Type: <input checked="" type="radio"/> C & C <input type="radio"/> MWFRS <input type="radio"/> Fascia Roof Length: 100.00 ft Roof Width: 20.00 ft	Design Wind Pressure: 62.6 psf		Negative Pressure: -41.64 psf Positive Pressure: 63.70 psf
NEGATIVE PRESSURE -46.34 psf	POSITIVE PRESSURE 42.72 psf	Design Wind Pressure: 62.6 psf		Negative Pressure: -41.64 psf	Positive Pressure: 63.70 psf

FROM THE COLUMBIA MISSOURIAN

02 DECEMBER 2009

AND JON PETERKA JPETERKA@CPPWIND.COM

Many younger members of the wind engineering community may not have known Henry Liu. While Henry spent most of his career in areas not related to wind engineering, he was an early proponent of wind engineering, especially within ASCE where he was one of several who were instrumental in starting the Aerospace Division and the Aerodynamics Committee on which many of us have served. During the time Henry spent in wind engineering, he wrote a book and put together a conference to try to bring building codes into alignment with current wind engineering knowledge. The following is material from the Columbia Missourian that was forwarded to a

number of us by Bob Meroney. I knew Henry from the mid-1960s when we were both graduate students in the Fluid Dynamics and Diffusion Laboratory at Colorado State University. Henry was always meticulous in his investigations and very curious about the world around him (by Jon Peterka).

COLUMBIA — The man killed in a single-vehicle crash on Interstate 70 Tuesday was a Columbia engineer and a retired MU professor known for his work in "green" technologies.

Henry Liu, 73, was traveling westbound near mile marker 129.6 when his 2003 Toyota SUV veered off the road striking two trees before coming to rest 200 feet off the road.

When Boone County Fire Protection District firefighters arrived at

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about 1:45 p.m., the vehicle was fully engulfed in flames. It took responders 10 minutes to extinguish the blaze.

The vehicle was completely destroyed by the fire, and the front end sustained the most damage in the crash.

Liu was pronounced dead at the scene.

Boone County Deputy Medical Examiner Ariel Goldschmidt said Liu died from injuries received during the crash. The cause of the crash is still unknown, according to the Columbia Police Department.

After earning a Ph.D. from Colorado State University, Liu worked as an MU civil engineering professor for more than 20 years. While at MU, he directed the Capsule Pipeline Research Center, which is funded by the National Science Foundation to develop capsule pipeline technology to transport freight.

"Henry was a model professor. He cared about teaching and did a good job teaching," said Mark Virkler, chairman of the MU Civil and Environmental Engineering Department and a former associate of Liu. "He had a very inquisitive mind and was quite ready to take knowledge from one field of engineering and apply it to another."

Virkler said Liu's academic background was in fluid mechanics and that his research led him to look at pipelines being used to transfer solids instead of only fluids.

In 2001, Liu founded Freight Pipeline Co., where he continued to be president.

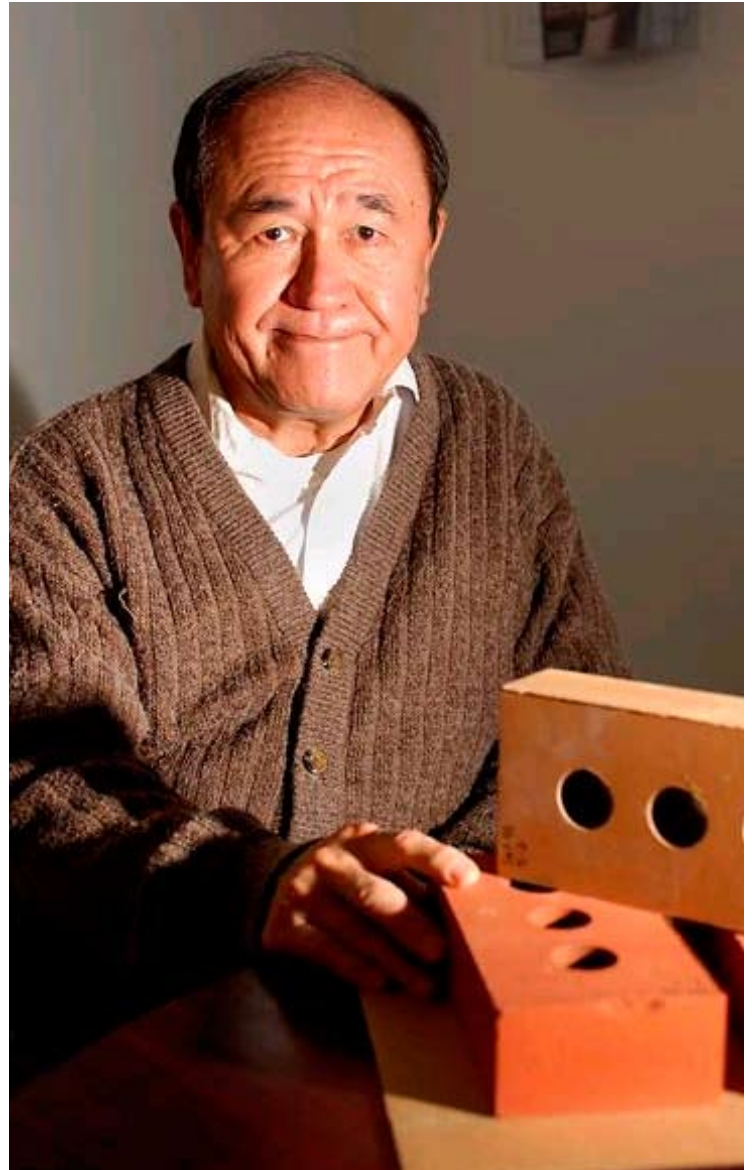
Liu was awarded the \$100,000 Purpose Prize award in October 2009 for developing environmentally-friendly bricks from fly ash — a toxic byproduct of burning coal. This production method is more efficient and does not contribute to air pollution.

"He was in the process of making the world a better place with his inventions," said Carla Roberts, Liu's administrative assistant at Freight Pipeline Co. "We plan to continue the projects that he has in motion now."

The final decisions rest with his family, she said.

Liu held or co-held five patents related to capsule pipelines and one related to combustion safety, according to his company's Web site. He also published more than 100 technical papers and two books.

"He is a hard man to describe because he was so complex. Basically, he is a man of great honor and he had a tremendous work ethic," Roberts said. "We all mourn his loss and will try to honor his legacy."



Dr. Henry Liu displays a brick he created by compressing fly-ash from coal fired power plants. The bricks earned one of 10 2007 Invention Awards from Popular Science and was named one of the best environmental inventions of 2007 by Time Magazine. Liu died in the one-vehicle accident Tuesday afternoon off the Lake of the Woods Exit on Interstate 70.

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Bartunek Professional Services is seeking a Senior Structural Engineer who is a PE and Washington SE with industrial facility experience. They will be the responsible engineer for a maintenance facilities associated with a wind farm project. The position is permanent with an outstanding company and is in the greater Kansas City area. Please contact Jeri Bartunek of Bartunek Professional Services on [800] 500 7823 or [913] 638 8335 or via email with resume to jeri@bartunekgroup.com.

THE UNIVERSITY OF HAMBURG, METEOROLOGICAL INSTITUTE, OFFERS THE POSITION FOR AN EXPERIENCED RESEARCHER (ER) WITHIN THE EU MARIE CURIE PROJECT WAUDIT "WIND RESOURCE ASSESSMENT AUDIT AND STANDARDIZATION".

The duration of the employment will be 12 months; Starting date could be January 1, 2010 or later; Salary is according to the EU regulations for ERs in Marie Curie Training Networks. Only applications from scientists with a nationality other than German can be accepted.

The successful candidate will work on the development of a standardised evaluation procedure for numerical models applied in the context of turbine siting for wind energy production. The work will be based on the method developed within COST action 732 for the evaluation of urban flow and dispersion models. The work includes the organisation of model evaluation workshops for the WAUDIT community.

The University of Hamburg is an equal opportunity employer. Women or disabled persons are given priority over legally unprivileged applicants with an equal suit-ability, qualification and specialized knowledge.

Applications are to be sent before December 15, 2009 to
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PRESIDENT'S CORNER



Happy New year to all our members and supporters! 2009 marked the end of an exciting year and decade; both saw big changes in many areas that have direct and indirect relevance for wind engineering, ranging from global warming (in a climate sense) to global cooling (in and economic one!).

It is important to reflect on this past decade. It began with the 2000 Atlantic hurricane season - a quite active season - with 15 named storms and 8 hurricanes; Hurricane Keith caused numerous fatalities and much damage in Belize, Nicaragua and Honduras. The 2009 season in contrast was relatively inactive, with nine named storms and three hurricanes; none brought hurricane force winds to the United States, but Ida drenched Atlanta. According to the World Meteorological Association, there were 245 natural disasters in 2009, of which 224 were weather related, accounting for 55 million people out of the 58 million people affected, 7000 out of 8900 of those killed, and US\$ 15 billion out of the US\$ 19 billion in economic damages. I could write many more paragraphs summarizing impacts over the past decade, but you get the point! In 2009 we also reflected - 20 years later - on the impact of Hurricane Hugo in 1989 at the ATC-sponsored conference in Charleston, SC. Clearly, our work is not done. While 2010 has begun with a deep freeze impacting much of the US, the world's tallest building - the Burj Khalifa recently opened in Dubai: a project whose very existence depends in

large part on what wind engineering can now achieve. So in the "work to be done" category: we have some, and your help is needed.

- We had a highly successful AAWE workshop in Vail, Colorado in the summer of 2008. We would like to organize another, and need a volunteer to work with AAWE leadership to host it. We had envisioned a "winter workshop" (which would mean a year from now) but can also entertain a summer event again, given the greater flexibility many potential attendees would have during that time period.
- We do not yet have a proposal for hosting the Americas Conference on Wind Engineering in 2013. Some interest has been expressed by a few groups, but we would like to get this pinned down as soon as possible. This time there might be other Americas organizations bidding, but at this point we are seeking interest from the "traditional" AAWE membership.
- There are two vacancies in the AAWE board. We would like to receive nominations as soon as possible so we can hold and election and fill these key positions. Please send any nominations to me or to Mike Gaus – Chair of the AAWE Nominations Committee.

We have an exciting year ahead. I hope that many of you are planning to attend the Computational Wind Engineering Conference in May in Chapel Hill. This will be a terrific meeting, and a great opportunity to "rub shoulders" with others in the wind-engineering community.

Sincerely,

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**American Association
for Wind Engineering**

Established in 1966

Objectives:

- The advancement of science and practice of wind engineering.
- The solution of national wind engineering problems through transfer of new knowledge into practice.

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