UMBC

AN HONORS UNIVERSITY IN MARYLAND

Department of Mechanical Engineering
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Advances in Understanding Stay Cable Vibration

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Abstract

Cable-stayed bridges have frequently exhibited large-amplitude vibrations of the main stays, frequently associated with the simultaneous occurrence of wind and rain. These vibrations have been of concern because they potentially induce fatigue in the cables and cable anchorages. Early research on excitation mechanisms had generally been conducted using wind tunnels, and several distinct aerodynamic mechanisms were proposed. While considerable progress has been made in understanding and mitigating these vibrations, the state of the art has still not enabled the prediction of field behavior based on a set of supplied parameters, nor does a plausible, fully accepted model exist for the phenomenon.

This presentation will summarize recent research efforts that have attempted to advance the state of understanding of this complex fluid-structure interaction problem. Both early efforts and recent investigations – primarily based on the collection and interpretation of comprehensive full-scale data – will be considered. In presenting these perspectives, focus will be placed on the use of a combined approach comprising observation, full-scale and laboratory (wind tunnel) investigations, analysis, and computational tools to develop understanding of aspects of this phenomenon and its mitigation, with it often being necessary to question past assumptions or assertions on the part of researchers and designers. In both understanding of the basic phenomenon, as well as in understanding the performance of mitigation systems, it became evident that preconceived notions about performance and assumptions in some instances clouded rather than aided the advancement of understanding.

The overall goal of these efforts has been to better understand the mechanics of stay-cable vibration at a more fundamental level and enabling the recommendation of more effective and economical mitigation strategies.

Biography

After graduating from the University of Auckland (NZ) with a BE (Hons) in Civil Engineering, Dr. Jones attended the California Institute of Technology, obtaining an M.S. in 1981 and a Ph.D. in 1986. In January 1986, he joined the faculty at The Johns Hopkins University as an

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Assistant Professor of Civil Engineering. He was promoted to Full Professor in 1995, and was appointed Department Chair in July 1999. From July, 2002 to August 2004, he was Professor and Head of Civil and Environmental Engineering at the University of Illinois at Urbana-Champaign. In August 2004, he returned to Johns Hopkins as Dean of Engineering.

His research interests include various aspects of structural dynamics, system identification, flow-induced vibration, earthquake engineering and wind engineering. Working in collaboration with Professor R. H. Scanlan, he established an experimental research program on aeroelasticity and aerodynamics of civil engineering structures using the low-turbulence Corrsin wind tunnel at Johns Hopkins. Scanlan and Jones collaborated on a number of bridge aerodynamics projects, including the aerodynamic analysis of the Baytown (Houston) bridge, the Golden Gate Bridge and the San Francisco-Oakland Bay Bridge in San Francisco, the Central Bridge in Cincinnati, the Kap Shui Mun Bridge in Hong Kong, the Seohae Bridge in Korea, and the Carquinez Straits Bridge in California. Dr. Jones' long-standing interest and involvement in wind-related problems associated with long-span bridges has led more recently to active involvement in stay vibration problems associated with cable-stayed bridges.

In 1987, he received the George Owen Teaching Award of The Johns Hopkins University. He was selected as 1988 Maryland Young Engineer of the year by the Maryland Engineers Week Council, and in 1989 was awarded a National Science Foundation Presidential Young Investigator award. In 1991 he received the Robert Pond Teaching Award of the Whiting School of Engineering at Johns Hopkins. In 1997, he received an ASCE Huber Research Prize. He was an invited keynote speaker at the ISBAP Symposium in Kobe in 1998 inaugurating the opening of the Akashi-Kaikyo Bridge, and at the International Symposium "Advances in Bridge Aerodynamics, Ship Collision Analysis, and Operation and Maintenance" commemorating the opening of the East Belt Bridge in Denmark (also in 1998). In 2001, he received an Alumni Association Excellence in Teaching Award. In 2008 he received the Robert H. Scanlan medal from the American Society of Civil Engineers.

He has been a member of the Seismic Effects Committee of the ASCE Structural Engineering Institute (SEI) (Chair, 1997-2000), the Wind Effects Committee of the ASCE SEI, and also chaired the Dynamics Technical Administrative Committee of the SEI (2000-2003) and the Aerospace Division of ASCE. In 2000, he was appointed by the President of ASCE to a four-year term on the ASCE Infrastructure Policy Committee. He served on the Board of Directors of the Maryland Section of the American Society of Civil Engineers, and currently the President of the American Association for Wind Engineering. He chaired the 8th US National Conference on Wind Engineering in June 1997, and co-chaired the 13th ASCE Engineering Mechanics Specialty Conference in June 1999, both held on the Hopkins campus. He is the past editor of the Journal of Wind Engineering and Industrial Aerodynamics.

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