LAUDATIO DAVID P. BILLINGTON

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It is my great pleasure and honour to introduce Prof. David P. Billington, who was awarded this academic year's Interfaculty Sarton Memorial Chair in the History of Sciences, on proposal of the Engineering Faculty. Moreover, I am particularly proud because apparently, it is the first time that this prestigious award is bestowed on a scholar in the field of structural engineering, a discipline coping with housing and transportation, two basic needs of our society, which are closely related to the history of our civilization.

David P. Billington was born in Bryn Mawr, Pennsylvania, in 1927. He spent one year in the U.S. Navy, and after graduating from Princeton University in 1950, won a Fulbright Fellowship for two years in Belgium to study postwar innovations in structural design. In 1951, he married Phyllis Bergquist and they have six children. He began in 1952 to work for Roberts and Schaeffer Company, consulting engineers in New York City where he spent eight years as a structural engineer on bridges, aircraft hangars, piers, thin-shell tanks and missile-launch facilities. In 1958, he was chosen to be a member of the six-man delegation to Russia to observe concrete construction.

Professor Billington was a Visiting Lecturer for two years before officially joining the faculty of Princeton University in 1960. In 1966, he was a Visiting Professor at the Technical University of Delft in the Netherlands. He was a visitor to the School of Historical Studies at the Institute for Advanced Study in Princeton in 1974-1975 and in 1977-1978. In 1984-1985, he was a Phi Beta Kappa Visiting Scholar, the first engineer in the 30-year history of this program.

Professor Billington teaches various courses on structural analysis and design at Princeton University. He also teaches a course on structural engineering to graduate students in architecture, as well as two courses in

engineering for liberal arts students, "Structures and the Urban Environment", begun in 1974, and "Engineering in the Modern World" begun in 1985.

In 1951-1952, he spent the second year of his stay in Belgium in the Laboratory for Reinforced Concrete. In those days, Prof. Magnel's Laboratory was known worldwide for its advanced research on prestressed concrete and many visitors travelled to Ghent to become acquainted with this new technique. Billington was involved in a research project on the dynamic testing of self anchorage in a prestressed concrete beam, under the supervision of Prof. Magnel.

In 1965 he published his first book *"Thin shell concrete structures"* which became a standard treatise on the subject. It was the first American textbook to provide students and practising designers with a combined treatment of the analysis and design of thin shell structures. The focus was on large-scale structures including roof shells and cooling towers. Considerable emphasis was placed on developing a single method of analysis for all types of thin shell structures. Such important factors as conversion of stresses into reinforcement, ultimate load behaviour, prestressing and the effects of dimensional changes on a system were considered in detail.

After these purely technical publications, his interest in the history and art of engineering resulted in a series of original papers and books which made him famous in the field of history of structural engineering as well.

His second book *"Robert Maillart's Bridges : The Art of Engineering"*, published in 1979, is an elegant study of the work and art of Robert Maillart (1872-1940), a creative Swiss engineer and designer of forty-seven bridges of extraordinary beauty that demonstrated the aesthetic and economic potential of a new material: reinforced concrete. Maillart's ingenious designs eliminated the heavy columns and solid arches that had dominated bridge building since Roman times, and through such innovations as the three-hinged arch and the deck-stiffened arch he was able to exploit the properties of reinforced concrete to make bridges simple, safe and inexpensive. In his book, itself an impressive example of the art of book design, Billington gives a scholarly account of the professional life of an influential genius. He explains the technical work in clear and authoritative

detail, and includes wise reflections that throw light on some of the central problems in the history of technology, on the role of art and science in engineering, and the interplay of economic, political, and aesthetic forces in the design of public works. He makes it clear that engineering is more than applied science. In structural design, he says, the choice of form rests first on an artist's vision and only secondarily on mathematical analysis. Billington's study of the art of bridge building is itself a distinguished contribution to the art of historical scholarship. For this book Billington received the 1979 Dexter Prize of the Society for the History of Technology. In 1990 he published *"Robert Maillart and the Art of Reinforced Concrete"* in which he further analyzed Maillart's work visually and technically. More recently, in 1997, he published the comprehensive biography: *"Rober Maillart. Builder, Designer and Artist"*.

In his fascinating book *"The Tower and the Bridge"* (1983), he introduces the concept of structural art starting with the striking examples of the Eiffel Tower and the Brooklyn Bridge. These two remarkable structures, as many others, are products of an engineering imagination that applies new materials and methods of industrial technology in the most economical and aesthetically pleasing way. In the opinion of Billington these structures constitute an exciting new art form, one that is distinct from both architecture and machine design. He argues persuasively against the idea that artistic imagination requires an indifference to the cost and utility of a structure and he explains how technical rigour in the design of bridges and buildings leaves room for aesthetic choice. Let us hope that, in this era with a trend towards standardized solutions for bridges, designers and authorities become convinced that it is also possible to conceive small and medium span bridges as unique structures in their particular environment, as witnesses of the art of structural engineering.

In much of his recent teaching and research, he has explored the connections between engineering and the liberal arts and has developed curriculum materials aimed at teaching engineering to liberal arts students. This resulted in his book "The Innovators" (1996) in which he gives a chronological survey of the first one hundred years of advances in technology. Besides all the previously mentioned activities, Prof. Billington continues to do research and consulting on a variety of technical problems in civil engineering, such as thin shells, bridges, and highways.

In 1985, Professor Billington was elected to the Executive Council of the Society for the History of Technology. In 1986, he was elected to the National Academy of Engineering and also received the History and Heritage Award from the American Society of Civil Engineers. Professor Billington was appointed an Andrew D. White Professor-at-Large at Cornell University in 1987. In 1990, he received the Dana Award for Pioneering Achievements in Education and an Honorary Doctorate of Humane Letters from Union College. In 1991, he received an Honorary Doctorate of Science from Grinnell College and in 1997 an Honorary Doctorate of Engineering from Notre Dame University. In 1998 he was elected as a Fellow of the American Academy of Arts and Sciences and in 1999 as an Honorary Member of the American Society of Civil Engineers. Also in 1999 he was named by the magazine "Engineering News Record" as one of the top 125 people in the Construction Industry over the past 125 years. Moreover, his outstanding capacities as a scholar have been recognized by several awards he received at Princeton University for excellence in teaching.

I am convinced that Prof. Billington, in his usual enthusiastic way, will enthrall the audience by his original and thought provoking ideas on the history of structural engineering.