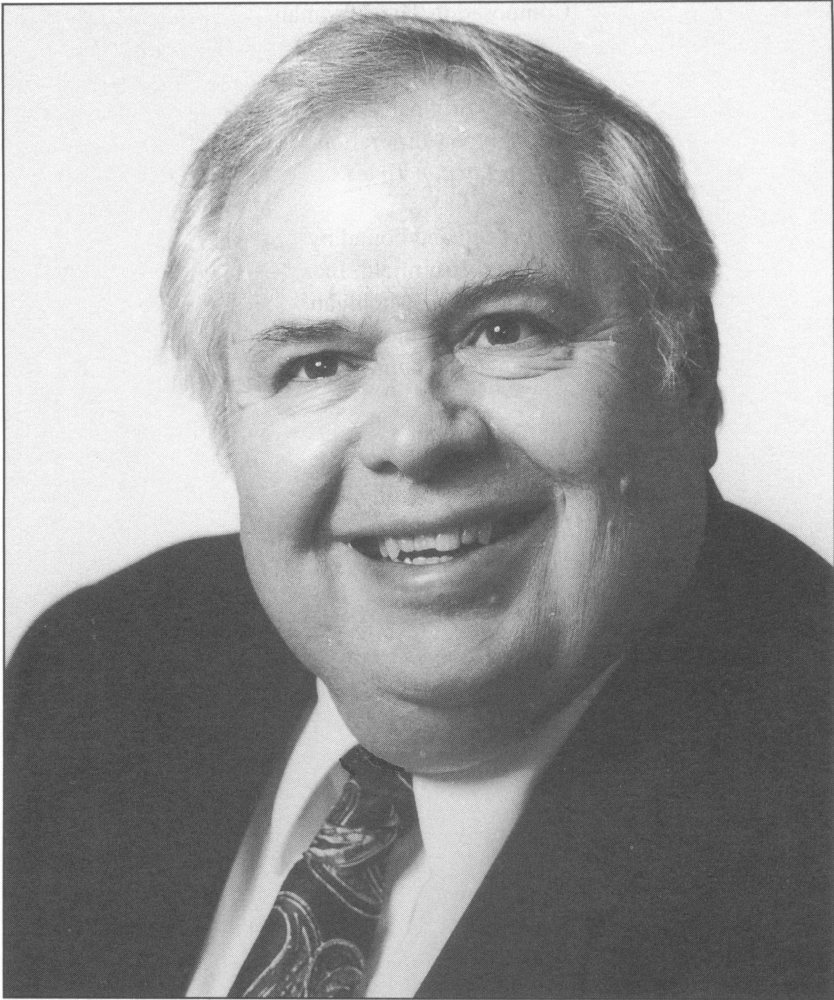


The Sabines at Riverbank

Their Role in the Science
of Architectural Acoustics

John W. Kopec



About the Author

John Kopec was born and raised in Chicago. After serving four years in the U.S. Air Force, he attended Chicago City College and the Illinois Institute of Technology (IIT). An employee of the IIT Research Institute (IITRI) since 1961, he manages IITRI's Riverbank Acoustical Laboratories in Geneva, Illinois. Kopec recently received IITRI's *Commitment to Excellence Award* for the third time—the first IITRI employee to achieve that honor. He is a Fellow in the Acoustical Society of America (ASA), a member of the Canadian Acoustical Society (CAS), the American Society of Testing and Materials (ASTM), and the New York Academy of Sciences.

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John W. Kopec

Woodbury, New York
Acoustical Society of America

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**This book is dedicated to Don Williams; Riverbank;
the IIT Research Institute; the Sabine family;
the Acoustical Society of America;
and all the past, present, and future individuals
involved in the challenging art and science of
architectural acoustics.**

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Preface

Wallace Clement Sabine (1868-1919) is the father of the science of architectural acoustics. During his investigations of the acoustical conditions in several Harvard University buildings, Wallace Sabine gained the confidence he needed to consult on the acoustics of the new Boston Symphony Hall being designed by the legendary New York City architectural firm of McKim, Mead, and White. This firm was formed in 1878 when Charles Follen McKim formed a partnership with William Rutherford Mead and William B. Bigelow. Bigelow retired the following year when Stanford White joined the firm and the firm's name was established. Largely on the basis of his success at Boston Symphony Hall, Sabine's counsel was sought on a wide range of buildings — the New England Conservatory of Music's new building in Boston; the Pulitzer House and Century Theater in New York City; churches and cathedrals in Los Angeles, Detroit and Boston; and the Rhode Island State capitol building. By 1916, Sabine's list of consulting projects had grown to include the chamber of the U.S. House of Representatives in Washington, D.C.; the U.S. Military Academy chapel at West Point; the Halifax Cathedral in Nova Scotia; the Remington Typewriter Company, where he advised on quieting typing clatter; and the Gustavino Company, for which he developed and patented a ceramic acoustical tile that found wide application in churches. His consulting files reveal that many of his projects after 1913 also involved noise and noise telescoping of heating and ventilating equipment sound and vibration. Clearly, Sabine was the foremost authority on architectural acoustics through most of the first quarter of the twentieth century.

One of Wallace Sabine's consultations around 1913 was with the wealthy industrialist, financier Colonel George Fabyan. Sabine met him at his estate in Geneva, Illinois, where the Colonel dabbled in various scientific enterprises. Fabyan had heard of Sabine's reputation in physics and acoustics through his brother Marshall, who served as a visiting adviser for the Fabyan Chair at Harvard Medical School. Marshall had retained Sabine to advise him on an acoustic levitation machine that was not working. During this consultation, Fabyan learned of Sabine's frustration with his inadequate acoustic isolation laboratory at Harvard and offered to build him a suitable one in the quiet prairie country of Illinois at his Riverbank estate. Sabine accepted the offer

and designed what was to become the internationally recognized Riverbank Acoustical Laboratory. He supervised its construction, which was completed just a few months before his untimely death in 1919 at the age of fifty.

Sabine's death left a great void at Riverbank, a void that was to be filled by two other Harvard physicists named Sabine: Paul Earls Sabine (1879-1958) and Hale Johnson Sabine (1909-1981). In 1919, Colonel Fabyan again turned to Harvard University to find someone to direct the new Riverbank Laboratory and was referred to Paul Sabine, a distant cousin of Wallace. Paul Sabine was working on a World War I research project in spectroscopy at the time and had had little contact with, or knowledge of, Wallace Sabine's work. Fabyan apparently charmed Paul Sabine into coming to Riverbank to direct what was then the only laboratory devoted to acoustical research and testing of acoustical materials and systems. Paul directed Riverbank during the critical, formative years and for nearly three decades thereafter until his death in 1958. During this period, Paul Sabine was also involved in founding the Acoustical Society of America and establishing acoustics as a respected and essential subdiscipline of physics. Paul's son, Hale, whose physics training at Harvard ultimately led him to the profession of acoustics, also became involved at Riverbank during the 1950s and 1960s to round out the leadership of the Sabines at Riverbank.

No one other than John Kopec with the historical perspective, patience, persistence, and inside knowledge of the Riverbank Acoustical Laboratory could have documented this extraordinary history. John's undamped fascination and enthusiasm for the Riverbank history began with his employment as a laboratory assistant there in 1974 and continues today in his current position as manager of the laboratory. He also serves as curator of the Riverbank Museum and of the Architectural Acoustics Archives of the Acoustical Society of America, located at Riverbank since 1984. About two years after the 1976 discovery of the Wallace Sabine research notebooks, John found Sabine's missing consulting files in a little-used storage room at Riverbank. He coauthored with Leo Beranek the article entitled "Wallace C. Sabine, Acoustical Consultant" (*Journal of the Acoustical Society of America* 69: 1-16, 1981). Without doubt, John Kopec has become the leading scholar on the Sabines at Riverbank.

In this volume, John Kopec masterfully weaves a fascinating story with many intricate details. It includes the involvement of an often controversial philanthropist and lover of science and scientific things, Colonel George Fabyan; the germination and execution of an idea for a state-of-the-art laboratory specializing in acoustical research and measurements; and the successive leaderships of three Harvard University-trained physics graduates named Sabine and their contributions spanning nearly three quarters of the twentieth century, toward the advancement of the profession and discipline of acoustics. Wallace Sabine's life and work has already been documented

thoroughly in William Dana Orcutt's affectionate biography, *Wallace Clement Sabine: A Study in Achievement* (Plimpton Press, Norwood, Massachusetts, 1933) and in Sabine's *Collected Papers on Acoustics* (Peninsula Publishing, Los Altos, California, 1994). However, the substantial contributions of the two other Sabines to acoustics have, until now, been less well documented.

It is clear from Kopec's history of the Sabines at Riverbank that architectural acoustics and, indeed, the wider field of applied acoustics itself involve a great deal more than merely the acoustics of auditoriums and churches. Even on his first important consulting project, Boston Symphony Hall, Wallace Sabine insisted on more than just the application of his new reverberation equation. He required adequate isolation of the hall's listening chamber from exterior sounds, hence the hall's interior surrounding buffer corridors and other features that protected the hall from exterior traffic and streetcar noise of the early 1900s and still do today. He also ensured shallow balcony and concert-stage depths to guarantee evenly distributed sound over all the seats and wall niches and deep ceiling coffers to enhance diffusion of the sound field throughout the concert hall. Wallace Sabine's later research focused more and more on unanswered questions of sound distribution and transmission and other unquantified problems in acoustics and noise control, and Paul and Hale Sabine continued his pioneering work. They, too, were deeply involved in the growing public awareness about noise pollution. Indeed, the need for methods and materials for environmental noise control became even greater after World War II, especially with the introduction of new and noisy transportation modes such as jet aircraft. The Sabines' and Riverbank's technical and research staff members were all part and parcel of this expanding acoustical activity. We are in John Kopec's debt for his dedication in telling the story of solid achievement of the Sabines at Riverbank.

William J. Cavanaugh

Fellow, Acoustical Society of America

Sudbury, Massachusetts

June 1994

Introduction

Many disciplines in the academic and professional world contribute to the science of architectural acoustics. Perhaps more than any other science, architectural acoustics illustrates the need for the integration of disciplines in order to fully understand physical behavior.

For example, medical people involved in hearing, speech, physiology, and psychology relate to architectural acoustics through the interaction between people and their home and work environments. Mechanical engineers relate to architectural acoustics through the analysis of the causes and effects of structural vibration. Physicists develop and explore the basic laws involving sound fields in rooms and auditoria. Electrical engineers develop instruments to detect, record, and measure sound in various architectural environments. Architects design buildings with the overall sound and vibration environment as a consideration. Musicians and performing artists are concerned about the environment in which they perform or practice. It was one specialized scientist, however, who ended my search for the discipline that architectural acoustics really belongs to. A space scientist thought architectural acoustics belonged to his profession, saying, “Is it not indeed true that the most popular scientific belief today on how everything started is based on the concept of the Big *Bang* Theory and that BANG as discovered by space scientists, was the original noise that effected the greatest feat of architecture ever accomplished — the formation of our universe?”

While researching the careers of Wallace Clement Sabine, Paul Earls Sabine and Hale Johnson Sabine, I found that each career unfolded slowly. As each Riverbank archive file was searched, I extracted bits and pieces. Eventually, not one but three outstanding careers emerged. When compiled, I found that each career exhibited a special aura of scientific magnificence.

Wallace and Paul Sabine were distant cousins, both having the same grandfather; Hale was Paul’s son. One Sabine career was not necessarily that much greater technically than the others, especially when you relate the professional significance with the respective time and generation for each. It is most apparent, however, that the professional careers of Paul and Hale Sabine were often placed in the comparative shadows of the extraordinary pioneering career of Wallace Sabine. By sharing the common denominator of the Sabine name, the many individual accomplishments achieved by Paul and Hale Sabine were professionally Sabine weighted. All three demonstrat-

ed dedication, individuality, and tenacity of purpose. When all three professional careers are combined and the total spectrum of scientific accomplishments listed, you become aware of the magnitude of the professional contributions made by this one family. That one family could have accomplished so much in one particular science is overwhelming. That all their achievements have passed almost virtually unnoticed through American scientific history is extraordinary.

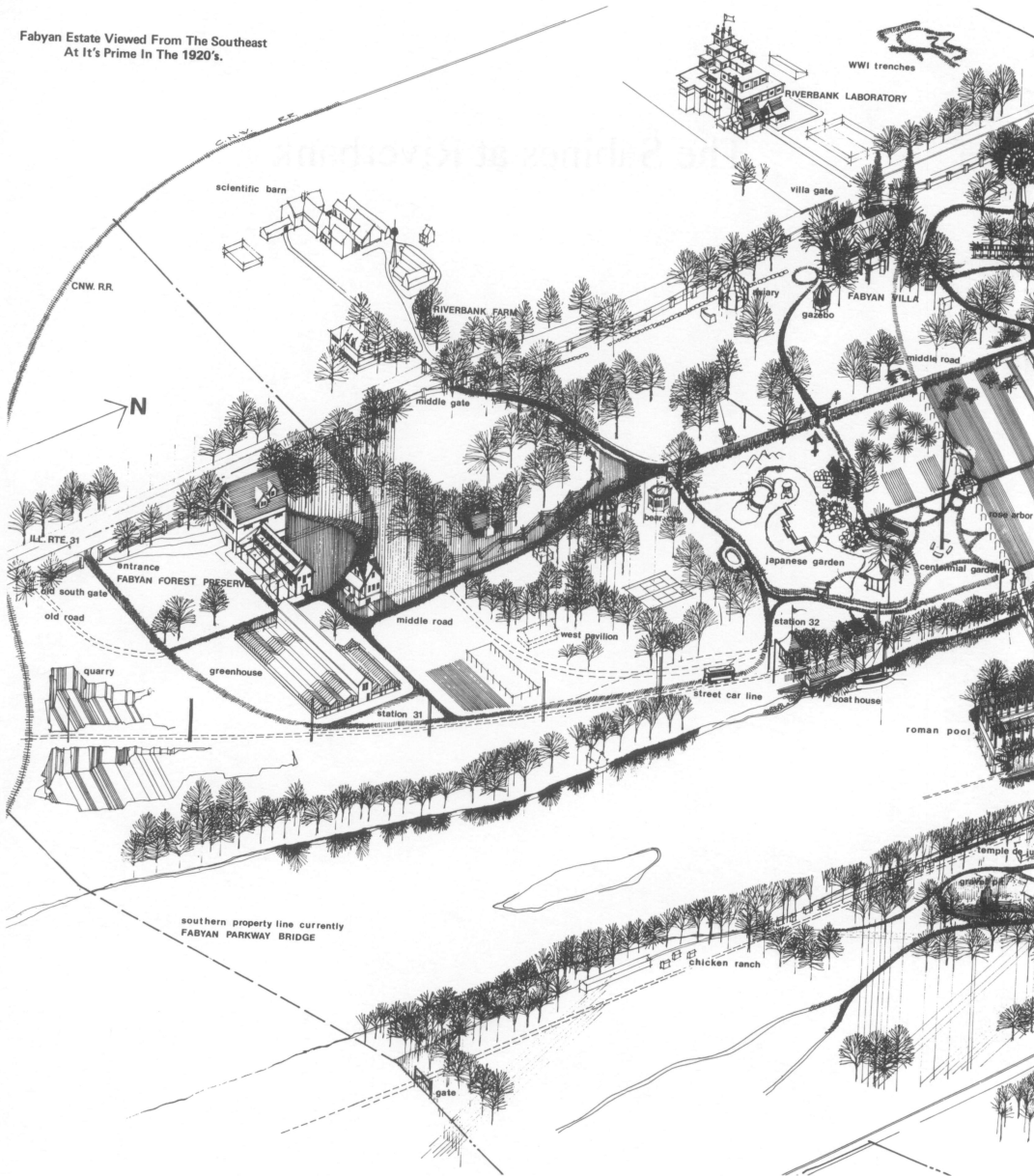
Much diverse material other than acoustics surfaced during my years of research. To reduce the interruption in the flow of reading, these diversions are indented throughout the book; the more lengthy diversions are consolidated in the postscript.

I hope that this book will help others to realize more fully the Sabines' contribution to the science of architectural acoustics and to understand what the Sabines meant to architectural acoustics, the Riverbank Acoustical Laboratory, Harvard University, the Acoustical Society of America, and me.

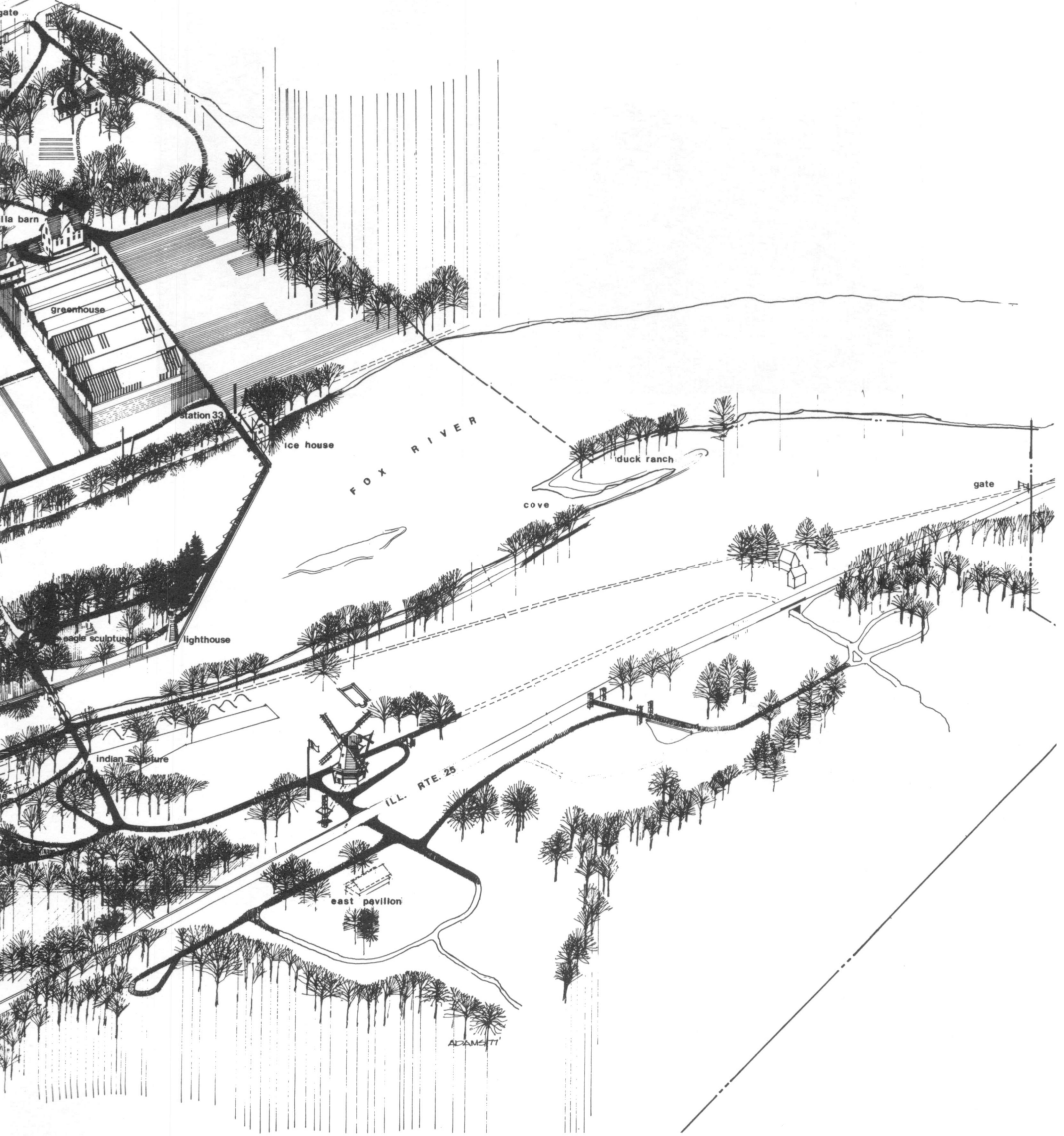
J.W.K.

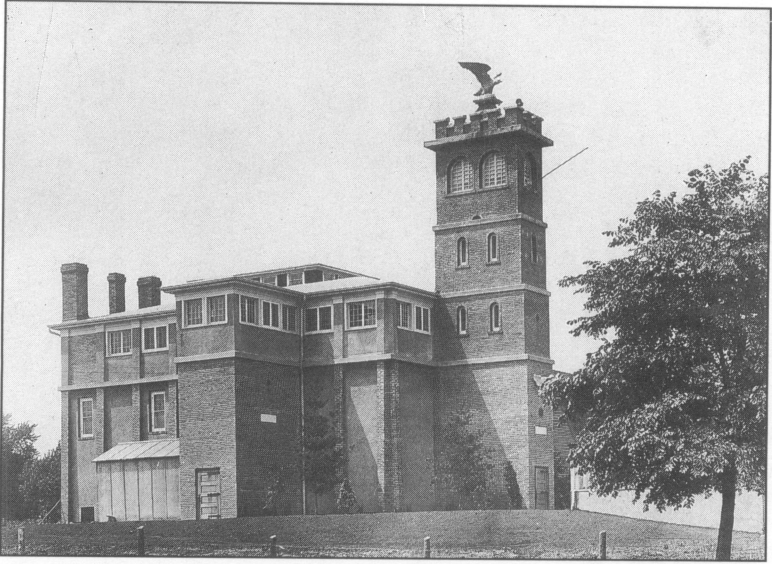
The Sabines at Riverbank

Fabyan Estate Viewed From The Southeast
At It's Prime In The 1920's.



northern property line
currently FOREST AVE.





Riverbank Acoustical Laboratories, ca. 1918.