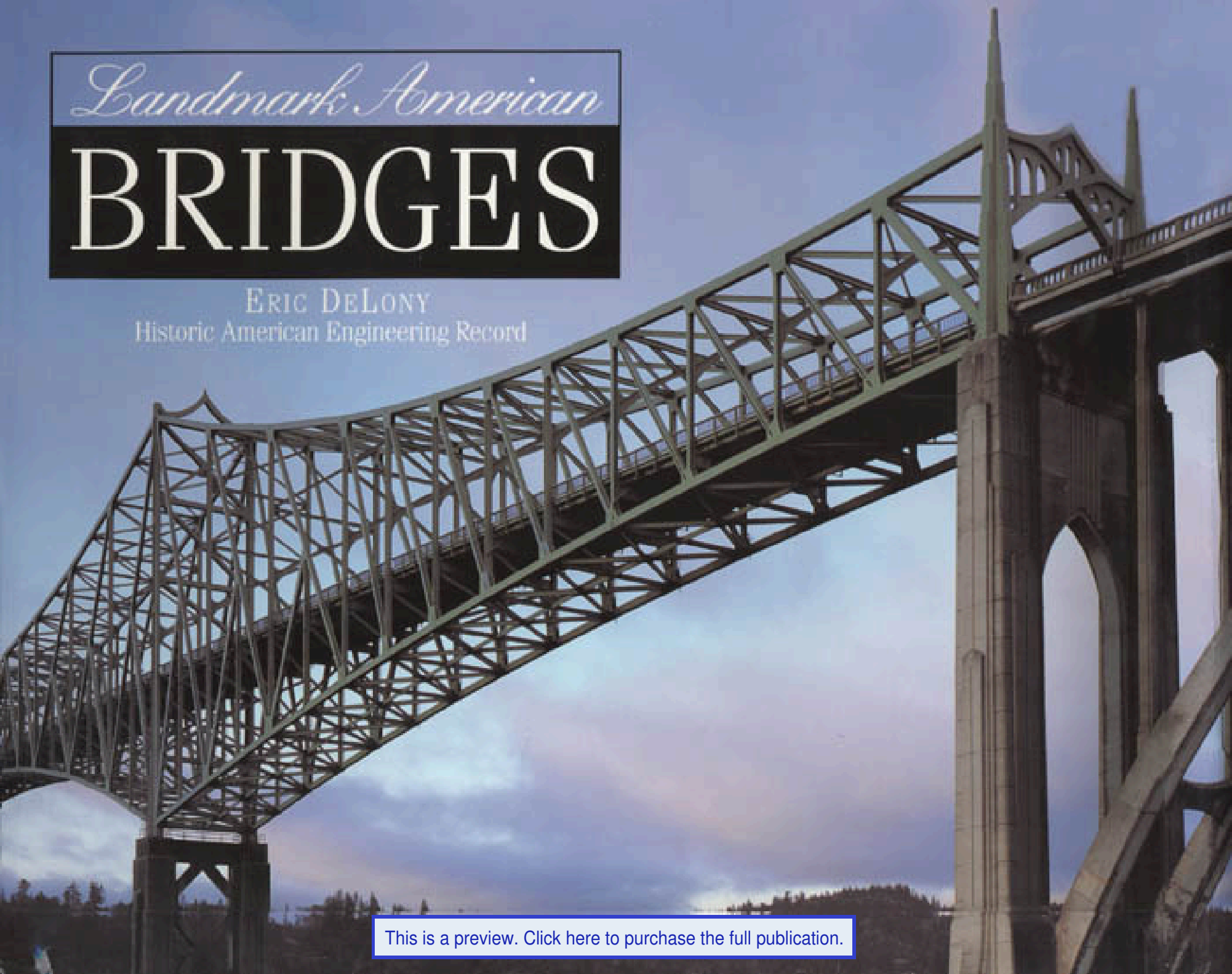
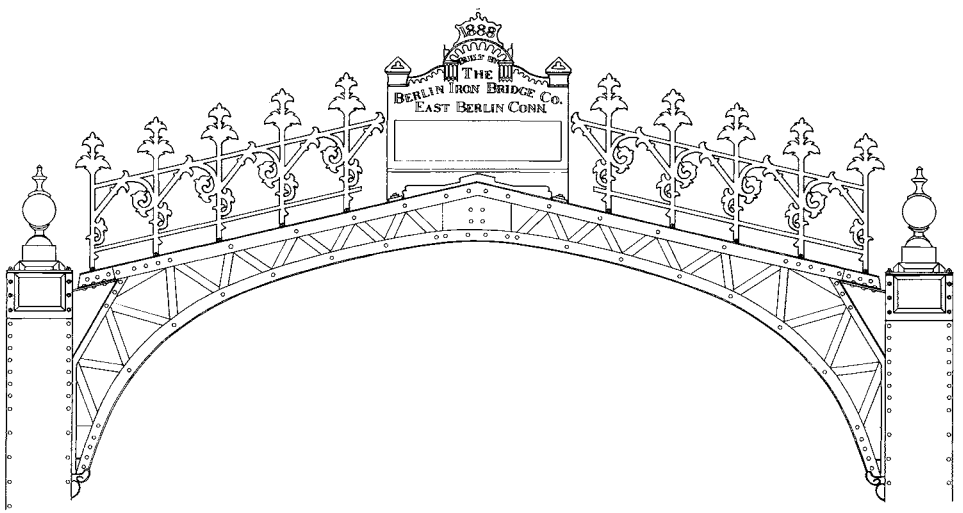
Landmark American BRIDGES

ERIC DELONY
Historic American Engineering Record





LANDMARK AMERICAN BRIDGES

ERIC DELONY

CHIEF, HISTORIC AMERICAN ENGINEERING RECORD

NATIONAL PARK SERVICE

U.S. DEPARTMENT OF THE INTERIOR

AMERICAN SOCIETY OF CIVIL ENGINEERS

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Bridges remain a timely and provocative subject not only in the history of technology and historic preservation, but in engineering, transportation, and urban planning as well. As the single most important artifact of rail and highway networks, a bridge's historic significance is critical to understanding the role it plays in America's engineering and transportation history. This book features over 200 images of approximately 90 American landmark bridges arranged chronologically so that the evolution of American bridge building is revealed. These images are from the collection of the Historic American Engineering Record (HAER) which was established in 1969 to create a graphic and textual archive of America's industrial and engineering achievements of historic interest. Through these drawings and photographs, bridges are shown to be testaments to engineering creativity, technological skills, and teamwork. Additionally, an introductory text, a timeline of bridge history, a bibliography, and a listing of bridges in the HAER collection enhance this visual history of bridge building in America.

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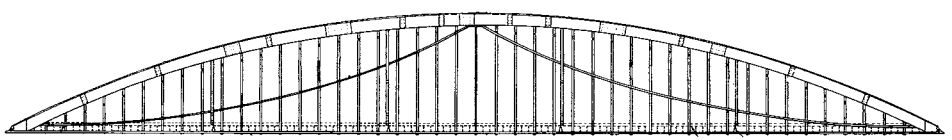
This book is dedicated to the hundreds of "pontists" who share the passion of saving the landmark bridges of America



Many people have contributed to the production of this book, but I want to recognize several who were particularly helpful. First is the chief of the HABS/HAER Division, Robert J. Kapsch, who created the opportunity to write the book of my dreams. He played a pivotal role in helping me with the book's planning and organization.

Virginia Fairweather, Editor in Chief at ASCE, was also instrumental in the start–up and planning of the book. Zoe Foundotos, ASCE's Acquisitions Editor, saw the project through from beginning to end.

HABS Historian Caroline Bedinger did yeoman's service pulling the drawings and photographs from the Library of Congress collections. Jet Lowe, staff photographer, spent days and evenings in the darkroom processing more than two hundred 11 x 14–inch prints, each hand–printed with immaculate care and quality.

Critical reviews came from Tom Peters, Neal FitzSimons, and Robert Vogel. Tom Peters, a great scholar and authority on bridges currently at Lehigh University, diligently checked and rechecked the timeline for accuracy. Neal FitzSimons, founder and first chair of ASCE's Committee on History and Heritage, reviewed captions. Robert Vogel, former curator of mechanical and civil engineering at the Smithsonian Institution and my favorite critic, read and commented on both the timeline and picture captions. The accuracy checks they provided were a comfort to me as an author. Additional thanks and accolades go to the designer, Stephanie Schaffer, and ASCE's Production Manager, Shiela Menaker, Neil Gaffney, Peg Peterson, and Geoffrey Howard at ASCE, and especially to Sherry Kay Campbell.

Writing a book is an individualistic experience. The author is ultimately responsible for all the contents. It also is a collaborative effort whose success depends on the interest, enthusiasm, and assistance of many people. I've been fortunate to have the very best photographer do all the printing, the very best reviewers to ensure accuracy, and the very best editors to ensure readability. To these people, I am eternally grateful.

Eric DeLony
Chief, Historic American Engineering Record

INTRODUCTION

Few would dream of tearing down the Brooklyn Bridge, the Golden Gate, or a wooden covered span, but the truly outstanding examples of our concrete arches, composite-cast and wrought iron trusses, steel trusses and movable spans are lost every day. We should, instead, equate the truly outstanding bridges with other U.S. landmarks. We should protect and rehabilitate them as we would Independence Hall, Monticello or Mount Vernon.

The U.S. Department of Transportation estimates that of 576,000 U.S. bridges, approximately 39 percent are structurally deficient or functionally obsolescent. Unfortunately, the same federal and state programs that help rehabilitate deteriorating highways often cause the destruction of historic bridges. With this book, I hope to identify these landmark bridges, to focus attention on those that illustrate the history of bridge building, transportation and engineering, and to encourage their preservation.

What is a landmark bridge? The Secretary of the Interior states that landmark bridges are those of exceptional value to the nation as a whole. They must illustrate or interpret the heritage of the United States in engineering, technology, transportation, industry, history or culture. Landmark bridges must also possess a high degree of integrity of design, materials, workmanship, setting, feeling and association. Nine percent of the bridges in the United States are eligible for listing on the National Register.

The Historic American Engineering Record (HAER) and the Historic American Buildings Survey (HABS) were established in 1969 and 1933, respectively, to create a graphic and textual archive of America's building arts—bridges, buildings, factories, churches and other historic structures. Together, these nationally valuable collections contain documentation on more than 1,000 American bridges. More than 900 bridges are documented in the HAER collection. The HABS collection documents the remaining 100. These archives, available to the public and housed in the United States Library of Congress in Washington, D.C., form the basis for this book.

Both the HAER and HABS programs function under an agreement among the Library of Congress, the National Park Service of the U.S. Department of the Interior, the American Institute of Architects and the American Society of Civil Engineers. A 1985 protocol expanded cooperation and support for the HAER program to include the American Society of Mechanical Engineers, the Institute of Electrical and Electronics Engineers, the Society of Mining, Metallurgical & Petroleum Engineers and the American Institute of Chemical Engineers.

It is important that we, as a nation, are aware of the types of common bridges that have been disregarded or overlooked even by preservationists and engineers. For instance, in a single generation we have nearly succeeded in eliminating one of the most important developments of the built environment—the prefabricated metal truss bridge.

The phenomenon of the metal truss symbolizes the fundamentally American values of entrepreneurialism, craft and unbridled invention and creativity. The metal truss helped Americans cross thousands of streams and rivers, reach new markets and create new businesses as the frontier moved west. Marking the desire to improve technology, hundreds of patents were granted in the 19th and 20th centuries. While many patents were granted to trained engineers, many went to the crafters—millwrights and mechanics. These were untrained "apple tree engineers," who recognized a need and sought engineering solutions that proved to be practical and sometimes a little bizarre. If not addressed now, these artifacts of the American landscape, both rural and urban, are threatened with extinction.

Fortunately, several programs have been set up to protect this engineering heritage. The current federal bridge program began with the collapse of the Point Pleasant Bridge over the Ohio River in 1967, in which 46 lives were lost. Following the work of a presidential task force, Congress passed legislation to enhance bridge safety. Landmark highway acts have since been passed, to establish bridge inspection, replacement and preservation programs. These

include the Federal Aid Highway Act of 1968, the Federal Aid Highway Act of 1970, the Surface Transportation Assistance Act of 1978, the Surface Transportation & Uniform Relocation Assistance Act of 1987 and the Intermodal Surface Transportation Efficiency Act of 1991.

Historic bridge inventories have been completed in nearly all states, thanks to these legislative initiatives. But, sadly, relatively few historic bridges have been rehabilitated, relocated or reused since the federal bridge rehabilitation program began in 1978.

Several reasons account for the widespread destruction of historic bridges. These relate to technical problems due to deterioration and to the implementation of the programs established by highway legislation. These aspects converge in the current system used for rating the condition of historic bridges.

All bridges inspected under the Highway Bridge Replacement & Rehabilitation Program (HBRRP), established by the Surface Transportation Assistance Act of 1978, are assigned a point rating to assess their overall condition. Points are given for structural adequacy, the assessment of the structural capacity of the bridge; serviceability and functional obsolescence, which measures the geometric and traffic-capacity features of the bridge; and the necessity for public use, which is the assessment of the frequency of use and the importance of the bridge to the highway system.

Fortunately, bridges with unsatisfactory ratings are eligible for federal funds. These structures were typically built for less traffic and lighter loads than are found today, have been damaged by traffic or deicing chemicals or have received little maintenance. Even when they are not structurally deficient, many older bridges receive low marks for serviceability and are then rated as functionally obsolescent. Some of these bridges are capable of supporting modern traffic, but may have poorly aligned approaches by today's standards or overhead structural ties that offer insufficient truck clearance.

For any number of reasons then, historic bridges are sometimes eligible for rehabilitation funds or replacement. With the aid of funds, some could be repaired or rehabilitated without damaging their historic character. This, however, has not always been the case. Nearly all projects using HBRRP funds require that assisted bridges meet the standards of the American Association of State Highway & Transportation Officials (AASHTO).

The 1991 Intermodal Surface Transportation Efficiency Act, known by its acronym ISTEA, is based on the flexible interpretation of the AASHTO standards and proposes to address positively environmental and preservation concerns in transportation planning. It is premature at this time to say how effective the new law will be.

Historic bridges can be preserved without endangering or inconveniencing the general public. Many historic bridges that do not meet AASHTO standards are perfectly serviceable. For example, AASHTO requires a 30-foot-wide deck. This width is impossible to achieve on many historic bridges built for narrower and one-lane roads. Yet one community, Allegan, Michigan, found an elegantly simple solution. After upgrading the structure, it made the bridge one way. Since other routes served the town, this solution worked well. Later, a traffic light was installed and two-way traffic resumed.

Historic bridge preservation is gaining momentum. The centennial of the Brooklyn Bridge in 1983 drew public attention to historic bridges, as did the 50th anniversary of the Golden Gate in 1987. There are environmental and quality-of-life reasons for saving old bridges as well. People are beginning to question the wisdom of having wider lanes and more efficient crossings that result in more cars and more development, rather than in lessening congestion and aggravation. Moreover, the staggering bill for repairs to the nation's road infrastructure in the years ahead demands alternatives to massive new construction.

Several state highway departments have initiated historic bridge programs. Where it has been tried, the repair of historic bridges has proven less costly than replacement. Ensuring the preservation of bridges, however, requires

commitment. The local government must document the condition of the structure and the costs of rehabilitation or replacement. Such a study should also document the bridge's safety history, which is especially important for structures rated as functionally obsolescent while being structurally sound. Often the record shows few or no accidents, rendering arguments for replacement due to poorly aligned approaches or other "design inadequacies" difficult to sustain.

Preservation alternatives for historic bridges include continued use for traffic or conversion to a new use. Continued use for traffic may require that a bridge be dismantled so that the parts can be inspected. Sound pieces can be reassembled, while damaged or deteriorated pieces can be replaced. If the structural system is weakened, it can be reinforced at times, in such a way that the new members do not show.

In other cases of rehabilitation, bridges may require geometric modification, involving significant changes to the bridge. The disadvantage to geometric modification is that the rehabilitation can destroy the structure's overall historic character.

Other treatments might involve realigning the approach roads or changing the use of the bridge. Still other solutions change the way a bridge is used, by converting a span to one-way traffic, lowering load limits or physically moving it.

Keeping a bridge in vehicular use is not always possible. Alternatives include moving bridges to roads or trails that do not require full-service bridges, such as bike paths, hiking trails, or state and national parks. In some cases, a new bridge has been built beside the historic bridge, which is then left to pedestrians and fishermen.

Another important facet of this book is the reference information on historic bridges. The appendix presents a combined listing of the bridges documented in the Historic American Engineering Record and Historic American Buildings Survey collections. A time line appears throughout the book to highlight significant events, publications, patents, technological innovations and personalities in the evolution of bridge building. This time line will help the reader place the American experience in context with that of the rest of the world. It will document American bridge engineers' and fabricators' claim to a portion of world bridge building advances.

The book is arranged chronologically so that, as you turn the pages, the evolution of American bridge building will be revealed. This visual journey of photographs and drawings is accompanied by captions that place the bridges in historical context. It is my hope that this book will create a greater awareness of the historic bridges of the United States.

Few people willfully destroy historic bridges. Most are lost through ignorance. To preserve the historic bridges of the United States, we need the special cooperation of people in transportation with engineering expertise. Preservationists, architects and historians working alone will only partially succeed. Bridges are engineered structures. Their successful rehabilitation requires the ingenuity of engineers.

Along with the experts, we need an informed public who recognize the significance of historic bridges and care that the best examples are saved for the enrichment of posterity. If the majority of the bridges in this book are still standing in 20 years, then the book will have been successful.

EDL

FOREWORD

The American Society of Civil Engineers (ASCE) has long known the critical difference between individual effort and group effort. What one can do well, a group of two or more working together can do even better. In civil engineering, individual efforts create achievements. From group efforts come monumental achievements.

The teamwork approach has resulted in countless U.S. civil engineering structures that improved American living conditions during the past three centuries. It is also very much alive and evident in Eric DeLony's celebratory *Landmark American Bridges.*

Mr. DeLony's work pictorially documents American engineering's finest hour: its bridges. From another perspective, this publication is a most worthy addition to the collective fruits of a partnership spanning over two decades: the close interaction between ASCE and the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER).

As an engineer by vocation and a historian by avocation, I've always had a deep admiration for America's bridges. With the publication of *Landmark American Bridges*, my appreciation for these structures and the teamwork that created them has grown immeasurably. In *Landmark American Bridges*, these engineering marvels taken for granted for far too long are finally given their due. In page after page, through words, drawings and photographs, DeLony shows us the real significance of American bridges. It is not just that these structures served as the geographical workhorses of U.S. continental trade, but also that they've always displayed a decidedly different union of utility and artistry. The bridges in this collection are at once examples of engineering creativity, testaments to our technological prowess as a nation and legacies of our ability as a people to cooperate with each other.

As the Industrial Age of America progressed, hundreds of bridge patents were submitted. But before these patents were tendered, the inventors researched and sought out the advice and concerns of those groups for which they wished to contract services. Even as bridge builders embodied the entrepreneurial spirit of their time, they were pioneering a business approach that resulted in progress for people via a cooperative team attitude that took into account the needs of the railroads and communities they sought to connect.

The very idea of connecting in itself is what a bridge does. Likewise, connection through a common goal is what makes teams work. For results, one need only look to the great structures dominating our skylines that serve as reminders to that team spirit. As brid

Sawyer once told a group of civil engineering students, "The Brooklyn Bridge was not built by John Roebling. It was built by *a team* led by John Roebling."

Mr. DeLony's historical treatise on bridges is the latest in a long line of activities born in 1969 out of a coalition of concern on the part of three groups: ASCE, the Library of Congress, and the National Park Service. With the active assistance of these groups, HABS/HAER serves as the nation's chief historical gatherer, cataloger, and reminder of our industrial and architectural technological heritages.

For the civil engineering community, the importance of HABS/HAER is simple enough. The group's work documents and preserves civil engineering's greatest contributions to civilization, thereby providing a historical safe haven for the profession's betterment of our world.

As civil engineers practicing so close to a new millennium, we need to know from whence we came in order to plot where we will go. Thus, ASCE's keen interest in the HABS/HAER goals of documentation and preservation have made it a longtime partner on numerous projects of great historical significance.

As civil engineers, we benefit from having HABS/HAER archive the achievements of our profession through various publications and other activities. *Landmark American Bridges* is the latest HABS/HAER publication in an exhaustive series of works that justly frame the American industrial experience. These publications and activities serve, inform, and instruct, providing a continuity of purpose for a profession that gains confidence via its past achievements.

Mr. DeLony's collection should be taken as a warning signal. This collection tells us that the wholesale removal of that which is old and obsolete only jeopardizes our perception of our nation's vision of its industrial and social heritage.

This book is a bold step toward preventing that occurrence. If history is a discipline that helps those of us in the present understand the past a bit more clearly, then we owe Eric DeLony our heartfelt gratitude. Just as his subjects gracefully span physical space, Mr. DeLony's collection works to span time, helping us to reconcile the achievements of our past with the challenges of our future.

Edward O. Pfrang
irector, ASCE

PREFACE

The idea for this book began at the opening of an American Society of Civil Engineers (ASCE) exhibit, organized by Curtis Deane, the Washington, D.C., manager of ASCE. It was Curtis, approximately twenty years after ASCE had helped found the Historic American Engineering Record (HAER) along the model of the older Historic American Buildings Survey (HABS), who began using HAER-produced drawings and photographs in ASCE exhibits. It was Curtis' idea to display the beauty of American engineering works through ASCE-produced exhibits. He used HAER photographs and drawings because of the very high quality of these images. And, we at HABS/HAER were very pleased to cooperate with Curtis and Susan Sarver in the production of those exhibits.

At this particular exhibit opening, I was talking to ASCE Executive Director Dr. Edward Pfrang. Ed and I had worked together years before at the Center for Building Technology, National Bureau of Standards (now the National Institute of Standards and Technology). We talked about how it was too bad that only a small fraction of the engineering profession, or indeed, the American public, would see these images of the grace and power of these engineering structures. We also talked about how each structure, particularly the innovative structures that somehow advanced our knowledge of engineering design and practice, represented a complete and interesting history in its own right. It was at that exhibit opening that we came to the conclusion that we needed to publish a book that could adequately convey the stories behind the design and construction of that beauty.

Eric DeLony, Chief of HAER, was a logical choice to write this book, select its illustrations, and otherwise oversee its development. Eric, an architect by training, developed his interest in engineering structures as a Fulbright Fellow in the United Kingdom almost twenty-five years ago. Upon his return to the United States, he found the ASCE, National Park Service, and Library of Congress struggling to develop a new organization to document outstanding examples of engineering—the HAER program. He became the first professional employee of that program and later its chief. He soon developed an overarching interest in the history of American bridge design and construction—not the romantic covered bridge of post colonial times but the metal truss and suspension bridges developed by an industrializing nation and designed by the new profession of civil engineering. For more than twenty years, Eric has been pursuing his interest in this aspect of our engineering heritage. During this time he has documented more than nine hundred outstanding examples of this engineering art many of which will be seen in these pages.

To implement the agreement between Ed Pfrang and myself, ASCE and HABS/HAER entered into a cooperative agreement. To oversee the publication process, ASCE appointed Zoe Foundotos, a very enthusiastic and energetic and thoroughly professional young woman.

This book is thus a cooperative effort between the American Society of Civil Engineers and the Historic American Engineering Record. It was ASCE that assisted in founding the HAER program, in 1969, to document America's engineering and industrial heritage. In subsequent years, HAER has created an archive of more than 2000 measured drawings, 34,600 large format photographs, and 2700 pages of history all housed at the Library of Congress, all processed for a 500-year archival life and all available for use by the public.

The HAER program is a unique blend of a public program supported by a professional society. The quality that HAER has achieved over the years is exceptional. This book provides only one small glimpse into the collection of documents amassed on America's engineering and industrial heritage.

Robert J. Kapsch
Chief, HABS/HAER

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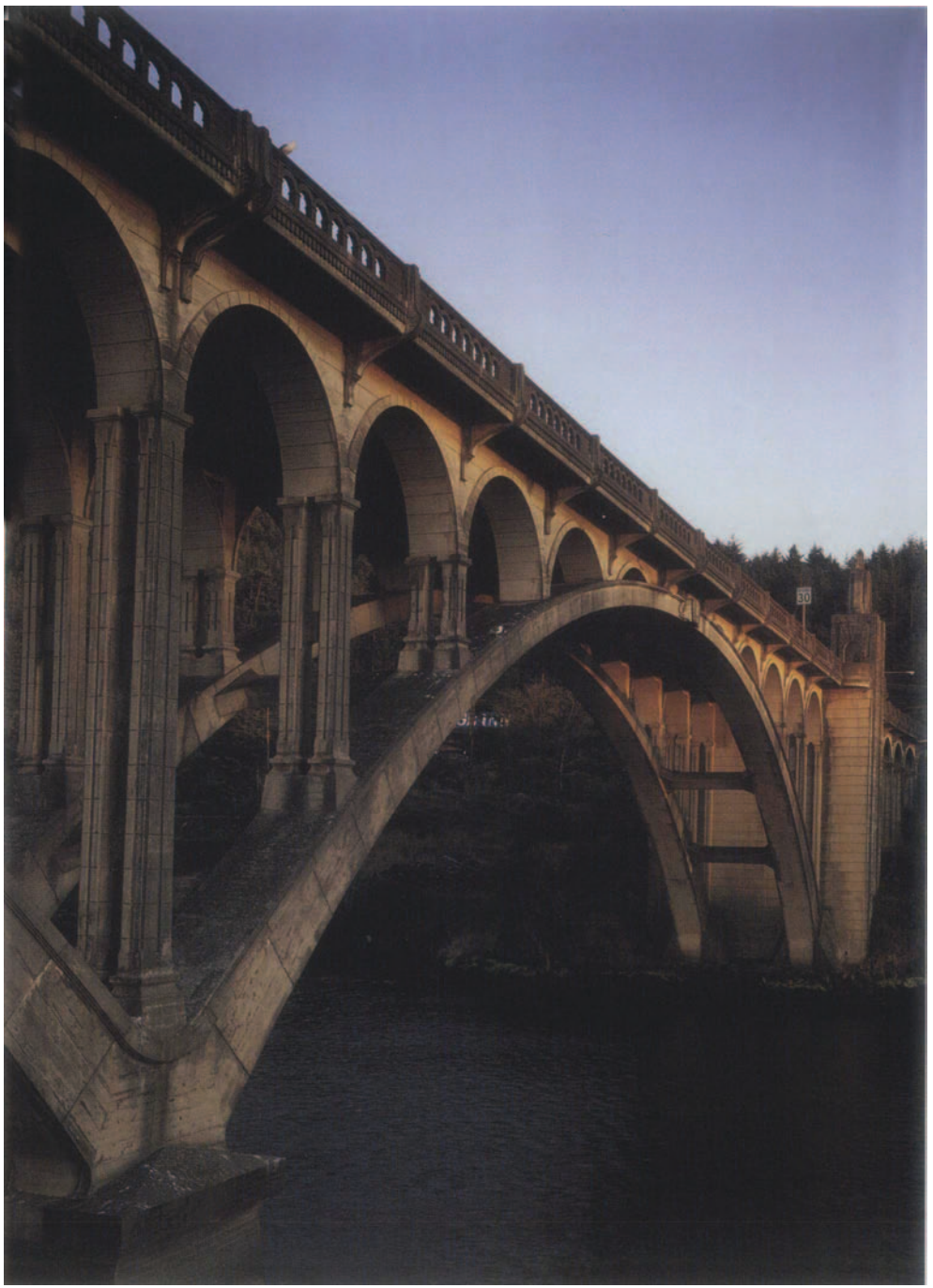

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