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Book review

The Structure of Skyscrapers in America 1871–1900: Their History and Preservation

D. Friedman Association for Preservation Technology International, Springfield, IL, USA, 2020, ISBN 978-0-9986347-1-5, $55.00, 442 pp.

Buildings like the Empire State Building in New York (NY, USA), Sears Tower in Chicago (IL, USA) and the Burj Khalifa in Dubai (UAE) and their representation, especially in cinema and photography, made the skyscraper the defining building type of the twentieth century. Donald Friedman, a structural engineer and co-founder of Old Structures Engineering based in New York, goes beyond the image to reveal the technological achievements that continue to inspire modern design practice.

The result is a book that is, as the director of the Skyscraper Museum in New York City notes, a heroic and Herculean task to catalogue the structural data of every tall building in America from the critical first quarter-century of the building type.

Friedman sets out three goals for the book: firstly, to create a uniform set of descriptions of the structure of these early tall buildings; secondly, how the structural forms came to be; and finally, how this knowledge informs their conservation. The author notes that skyscrapers were neither necessary nor inevitable. The many non-technical reasons for the tall building boom in North America have been set out in other books and are not repeated here. Instead, the author looks at the structural technology that was available and was developed in response to the demand to build higher. It was a revolution, 'conducted as a series of fairly small steps taken in rapid succession over 15–20 years'.

The minimum requirement for inclusion in the book is for a building to have a minimum of ten storeys, an arbitrary figure that the author acknowledges to keep the study to a manageable size. Even so, the appendix, which forms over half of the book, provides a detailed summary of over 440 buildings. The criteria for categorising building frames is discussed, such as how the structure deals with gravity and lateral loads, the type of floor system, methods of fire protection and the type of support to the external enclosure. This leads to a chapter on the development of the building frame where archival drawings and photos are used alongside modern plans and sections to clearly show the development in the form of tall buildings. The earliest buildings were traditional in form, if not in scale, and built with masonry walls. Cast-iron columns were then introduced internally to allow more flexibility in the layout of rooms. Then, wall- and frame-braced cage structures were developed where the external masonry only carried its own weight. The final development was for skeleton-framed buildings where all loads are carried by the frame, as exemplified by the front cover showing New York's Flatiron Building under construction in 1902.

The book explores the reasons why building systems changed. The catastrophic fires in Chicago in 1871 and Boston (NY, USA) the following year trigger a general reappraisal of building technology and the need to reduce the amount of combustible material. Developments in building services and elevators played a key role, and cost was another factor worth considering. Improvements in the speed of construction were also an important consideration. Erecting a metal frame, rather than laying masonry, dramatically reduced the time to build the structure and also allowed follow-up tasks, such as adding the external cladding and installing internal finishes, to overlap.

What makes the book especially important is the chapter on alterations and conservation. Although the book was written for tall buildings, there is much valuable information for the other buildings of this period. For example, the descriptions of floor systems from the late nineteenth century will be helpful to those working on more modest-scale buildings. The author notes that the first reinforced concrete structure to meet his criteria was the Ingalls Building in Cincinnati (OH, USA), erected in 1903, which is therefore beyond the scope of this book. After such a mammoth undertaking to produce this exemplary book, the benchmark has been set to continue this fascinating journey into the twentieth century.

Stuart Tappin