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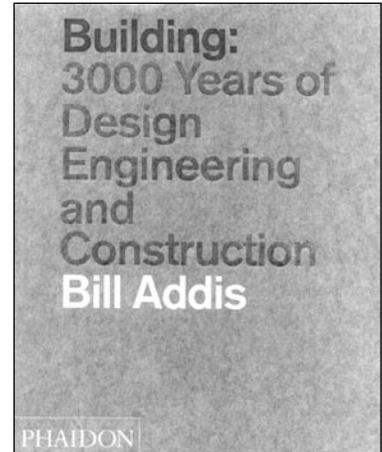
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Bill Addis. *Building: 3,000 Years of Design Engineering and Construction*. London: Phaidon Press, 2007, 640 pp., color and black-and-white illustrations, cloth, \$75.00, ISBN 978-0-7148-4146-5.

The history of structural engineering has unfolded with dramatic achievements resulting in a complex infrastructure of buildings and their supporting structures. Civil and structural engineers are among the heroes who created such urban environments. Yet, these innovators have been largely written out of books on the history of buildings and cities. Unfortunately, architectural history has traditionally championed designers over technicians, partly due to an unjust bias against the practicality of civil engineering. Bridging the divide, Bill Addis's recent book, *Building: 3,000 Years of Design Engineering and Construction*, offers a historical account of the built environment viewed through the lens of the brilliant engineers who applied their knowledge to architectural structure.

Addis coins a term for his lens: design engineering, which inextricably binds the discipline of architecture with the structural principles of construction. He crafts a historical narrative that definitively accounts for the innovations in beams, columns, and trusses generated by investigations into iron, steel, and other building materials. He also traces the architectural developments that resulted from research into acoustics and heating and cooling systems. As a result, drawing-design traditions, or *disegno*, are purposefully downplayed; for Addis, design is more science than art.

A remarkably fresh account of industrial architecture emerges here in celebration of engineers who are usually sidelined by less technical accounts. Addis dramatically revises the canon of architectural history by telling the fascinating story of well-engineered structures, such as factories, department stores, textile mills, and commercial office buildings. Organized chronologically, the book also explains how engineers contributed to construction by asking a fundamental question: How does the history of architecture look if engineering and structural science dictate the criteria upon which buildings are judged? Framed thus, *Building* addresses readers who already possess an introductory knowledge of structural mechanics.

The resulting story about architecture unsettles the myth that structural engineers established a trajectory culminating in iron-frame and steel-frame construction. Architectural historians have long told of how engineers progressed along a path that explored the structural potential inherent in the skeletons of buildings. Addis paints a markedly different history by attending to the practical concerns of acoustics, economics, fireproofing, ventilation, manufacturing efficiencies, and temperature controls. He clearly shows that advances in engineering resulted not from finding architectural formulas to display the spatial potential of sophisticated buildings but rather from experiments in fireproofing and efficient manufacturing that sparked profound scientific discoveries.

The industrial concerns of engineers come forth, for example, in the story of William Fairbairn, an iron manufacturer who launched Eaton Hodgkinson's explorations of how I-section and inverted T-section iron beams compensate for iron's inherent weakness in tension. Fairbairn and Hodgkinson together produced the train bridge at River Conway and Menai Strait, designated by the author as "the greatest structural engineering achievement in history" (pp.317-318). Addis also shows how efforts to control temperature and provide ventilation hastened some of the most innovative advances of the nineteenth century. The author's emphasis on the mechanical processing of standardized parts for Joseph Paxton's Crystal Palace serves as one example of how industrial concerns led to highly innovative structures.

Addis's important contribution to architectural history augments the criteria by which buildings are judged to include engineering and structural innovation. Nonetheless, the book reveals a bias toward industrial approaches. Ancient contributions to calculating curved columns or early experimentation in concrete vaults certainly figure into the account but receive nowhere near the detail that Addis applies to nineteenth-century manufacturing techniques. Further attention to pre-modern engineering might have provided insight into what historic buildings can teach us about passive solar energy and natural ventilation. The book presumes previous exposure to structural engineering, offering little information on ecological, economic, or social concerns. The greatest concern is that the numerous illustrations are often too small. Finally, Addis's account calls for new investigations probing how the built environment contributes to economic injustice and global warming. Despite these issues, Addis's book will surely be of great interest to scholars at all levels.

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