

STRUCTURAL SYSTEMS

ARCHITECTURAL ENGINEERING DESIGN

Robert Brown Butler

CD-ROM Included

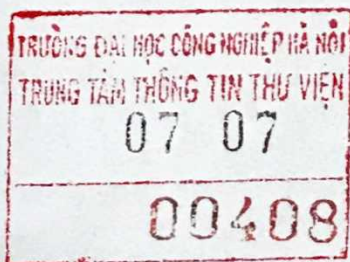


ARCHITECTURAL ENGINEERING DESIGN: STRUCTURAL SYSTEMS

Includes one CD of
Computerized formulas



Robert Brown Butler



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**GIFT OF THE ASIA FOUNDATION
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**QUÀ TẶNG CỦA QUỸ CHÂU Á
KHÔNG ĐƯỢC BÁN LẠI**

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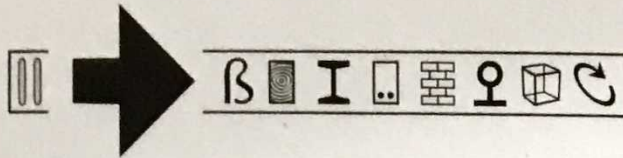
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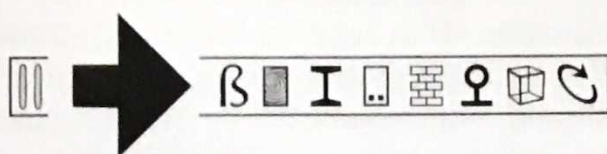
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INTRODUCTION

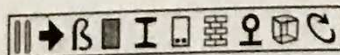
1.A. GENERAL

This publication includes two \mathcal{AE} (architectural engineering) handbooks, this one dealing with the design of structural systems and related components, the other doing the same with mechanical systems. Each volume also contains an interactive CD-ROM of its algebraic formulas that enables each equation to be solved quickly and accurately by computer.

These handbooks and their accompanying disks contain architectural engineering information and algebraic equations for conceptualizing, selecting, and sizing virtually every functional component in any kind of building, from shed to skyscraper, anywhere in the world. With these references, an \mathcal{AE} designer can quickly determine whether a functional component is large enough to be safe for its intended purpose, yet not so large that money is wasted. Certainly these volume-cum-disks are thorough compilations of technical knowledge acquired from academic study, official research, and established office practice. But they also contain countless practical, insightful, and even a few horrifying anecdotes gleaned from construction experiences, water-cooler dissertations, trade magazine edifications, and numerous other in-the-field events as they relate to our species' ongoing need for safe and comfortable shelter.

These publications also emphasize the latest computerized controls being incorporated into every functional aspect of today's buildings. Today's \mathcal{AE} designers cannot claim to be up with the times if they do not understand TBM systems. This includes the incredible production and energy savings they can bring, the mysterious problems they create, and the solutions today's engineers are evolving to eliminate the latter.

These volumes also stress that a vital aspect of any functional component's design involves adequate access for maintaining it after construction; because it can be said that no matter how good any part is, it always fails eventually. Architects may think, and rightfully so, that maintenance is not their problem; but *accessing* maintenance is no one else's problem. More than ever before, occupants of modern buildings are prisoners of maintenance; and today's \mathcal{AE} designers should be an ally to these



often-overlooked confinements and not an adversary.

These volumes also emphasize environmentally appropriate architecture whenever possible. They expostulate the view that not only should every building inflict minimum damage to its site and environs, but every material in them should inflict minimum environmental damage, undergo minimum processing, create minimum packaging waste, and consume minimum energy on its journey from its home in the earth to its grave on the site. Indeed, the hallmarks of environmental design —more than economizing energy use and minimizing toxic waste— are creating maximum comfort in minimum volume and assembling natural materials simply. There is a vital reason for this: the *wilderness ratio*, which states that

Every urban square mile requires about fifty square miles of wilderness to purify its air, recycle its water, absorb its wastes, modify its climate, and provide a substantial portion of its food and fiber needs without economic cost or human management. [†]

In architecture this is the ultimate catchment. The wilderness ratio indicates that we all must do everything we can to preserve nature as much as possible —not so our children may enjoy its serene majesty someday, but simply so they may *breathe*. This is especially important with buildings, for their construction and operation is a conspicuously consumptive use of natural resources; thus this publication promotes every possible energy-conserving measure involved in erecting and occupying built environments. Such concern certainly includes conservation of electricity; as in the United States an estimated 35 percent of all CO₂ (a greenhouse gas), 65 percent of all SO₂ (a leading contributor of acid rain), and 36 percent of all NO_x (a major ingredient of smog) are produced by the generation of electricity. [‡] But such concern also involves advocating thicker envelope insulation, structure with maximum strength-to-weight ratios, efficient lighting and climate control systems, occupancy sensors that turn lights and heating off when a space is unoccupied, daylight harvesters that dim artificial lights when sunlight enters interior spaces, plumbing fixtures with no-touch controls that reduce water consumption, TBM systems that lead to lower energy use, and any other means of producing the greatest effect with the smallest mass or means. Each comprises environmental design so far as architecture is concerned, as a way of providing greater opportunity to do the same in the near and far future.

Also let it never be said that these two volumes, in their preoccupation with a building's solid parts, imply that they are more important than the spaces they enclose. On the contrary! Obviously the Essence of Architecture is creating habitable and comfortable interior spaces —for without the voids, you have no solids. But just as obviously, you cannot have the spaces without their defining solids, a fact that Laotze poetically described twenty-five centuries ago when he said:

[†] *The Ecological House*, Robert Brown Butler (Morgan & Morgan, Dobbs Ferry,

Thirty spokes converge in the hub of a wheel;
But use of the cart depends on the part
Of the hub that is void.

A clay bowl is molded by its base and walls;
But use of the bowl depends on the hole
That forms its central void.

Floor, walls, and roof form the shape of a house;
But use of the place depends on the space
Within that is void.

Thus advantage is had from whatever there is;
While use derives from whatever is not.

In this endless architectural interplay, the essence of habitable space underlines the need for its physical imperatives —and these books, by their preoccupation with the latter, hope to ennoble the nature of the former.

Finally, these volumes' methods of selecting and sizing virtually every functional component in a building —of paring each down to its elemental nature and nothing more— promote all that is beautiful in architecture. For the truest beauty results from doing what is supremely appropriate and the subtraction of all else. For example, take the caryatids of the Erechtheion in Athens, perhaps the loveliest columns ever devised: only when each slender feminine waist was given the slimmest section that would support the mass above could these graceful forms transcend the bland loyalty of posts to become a beauty so supreme that they hardly seem like structural supports at all. Such functional modeling is all a building needs to be beautiful. No excess. No frills. No confections masquerading as purpose. No appliqué as are so often borrowed from the almsbasket of historically worn architectural motifs whose perpetrators typically have no more concept of their meaning than did Titania of the donkey she caressed.

Indeed, regarding architectural beauty, an Æ designer needs no more inspiration than a simple flower. From what does its beauty derive? Not from perpetrators of vanity lurking within that blossom's corm, yearning to conjure a titillating aspect upon an innocent eye. And not from any external molders who aver to do the same. No, its beauty derives from nothing more than the sternest utilitarian arrangement of each and every tiny part, wherein each element has the most utilitarian size, each has the most utilitarian shape, each connects to each other in the most utilitarian way, and each interfunctions with the others in the most utilitarian manner, wherein each molecule in each part is placed there for a specific purpose —in which even the dabs of garish color on the frilly petals are, at least to a bee's eye, no more than applications of sternest simplest utility.

So be it with buildings.