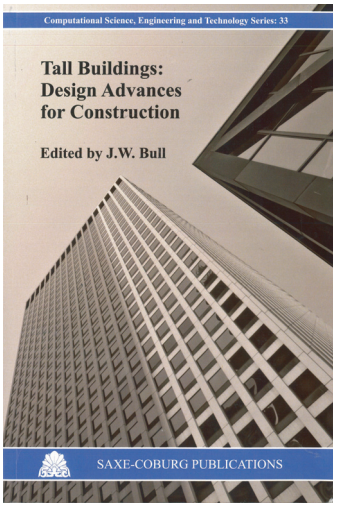
Review

John Parker finds this collection of papers to be something of a mixed bag, with some very useful and well set out, but others less so. Overall, though, he concludes that it would make a good addition to the library of any engineer designing high-rise buildings.

Tall Buildings: Design Advances for Construction



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This book is a collection of papers on various aspects of the structural design of tall buildings. A general chapter provides a simple introduction; there are three papers on various aspects of monitoring; and the remainder cover wind, earthquake and blast loading.

Two of the papers on wind loading are particularly useful to engineers engaged in the design of tall buildings – particularly in the early stages, when the form of the building and its relationship to other structures in the development are being considered.

One demonstrates the effect of coupled modes: that is, modes of vibration where the building response is amplified by vortex shedding at frequencies close to the natural frequency of the building; and where the building has two or more modes with almost the same frequency. The authors describe the effect mathematically, and then use examples and graphs for illustration and clarification.

A second paper describes the influence of closely spaced buildings on each other. A large number of tests were carried out using square and circular plan buildings at different spacings upwind and downwind, and displaced laterally from the centre of the flow. Graphs illustrate the increased or decreased forces that were observed. One surprising result is that a nearby building downwind can significantly increase buffeting loads on the upstream building. Of course, it is rare to have a building that is perfectly square or circular, but the paper would be of use in the stages before wind tunnel tests were carried out.

One paper describes the damage observed in buildings following an earthquake in Taiwan in 1999. Many buildings failed because of ignorance of the consequences of poor construction, because confining reinforcement was not provided, or because soft storeys existed in otherwise stiff buildings. In some cases, buildings had been designed as concrete frames with uniform stiffness on every floor, but 'non-structural' masonry infill on the upper floors introduced additional stiffness, leaving a relatively soft storey of glazed retail units at ground-floor level. As the authors note, these lessons are not new, and the global construction industry should not need to learn them over and over again.

The paper on blast loading explains the mechanics of shock waves, with application to tall buildings. The phenomenon of 'clearing' is explained: a negative pressure wave propagates from the edges or top of a building and reduces the maximum positive pressure.

Papers on measurement describe different monitoring techniques and their successful application in gathering data during earthquakes and wind storms. Accelerations are reasonably easy to measure, but inter-storey drift (the horizontal movement of one floor relative to the levels above and below) appears to be the most difficult of all measurements to obtain.

Some of the papers are less useful. One compares wind load calculations for the World Trade Centre in New York (demolished on 11 September 2001) using either the current Eurocode or the Portuguese wind code. Another concludes that earthquakes occurring 350km from the building rarely constitute the most critical load case. And many papers suffer from the use of long strings of adjectives, at considerable cost to their clarity.

The book concentrates on aspects of tall building design where structural engineers work alone. It does not cover areas where they need to co-ordinate with other disciplines. Some of the most challenging aspects of high-rise design are in providing lateral stability and stiffness without adverse effect on interior layout; in designing the building for safe, rapid and economical construction; and in the co-ordination of structure with vertical transportation, mechanical and other services. Guidance in these areas would be helpful.

These points aside, however, the book would be a useful addition to the library of an engineer involved in the design of high-rise buildings. It would provide background knowledge for the early stages of projects and would help to facilitate discussions with specialist designers in later phases.

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John Parker is a Senior Technical Director at WSP | Parsons Brinckerhoff. He led the structural engineering team responsible for the Shard, and is currently involved in the design of numerous tall buildings ranging from 25 to 69 storeys in height.