the subsequent calculations is explained and illustrated by a worked example. The approach is based on BS 8110: 1985, supplemented where necessary by the earlier Concrete Society Technical Reports on flat slabs and post-tensioned design. In the few instances where there is a discrepancy the more conservative recommendation is adopted.

A preliminary approximate shear check is recommended, and this is followed by the determination of the number, spacing and profile of tendons using the load-balancing method with the aid of simple formulae. An accurate calculation is then made of the stresses in the slab at the critical sections, allowing for the secondary effect of prestress by moment distribution, using factors provided to obtain the fixed-end moments and making due allowance for the loss of prestress. The ultimate limit state is also checked by this method, but here it would have been helpful to have demonstrated the moment redistribution permitted in

BS 8110, which is more stringent for prestressed than for reinforced concrete structures. Punching shear calculations according to BS 8110 are shown, and some points of detail are considered, even including a system of notation for tendon layout drawings.

Shorter chapters are devoted to the design of ground slabs, cylindrical tanks and silos, also to work on site, and the book concludes with an illustrated description of the main prestressing systems available with unbonded tendons. There is a useful set of references and the text is clearly written with practical considerations always in view, even if the view would in some places be improved by a better standard of photographic reproduction! None the less, a book to be welcomed.

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Fly ash in cement and concrete

Richard Helmuth

Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077, USA, 1987. 228 × 148 mm. pp. iv, 203. Typeset, illustrated, paperback. ISBN 0 89312 085 5. Price \$45.00.

This is essentially a state of the art review book on the subject of fly ash as a cementitious material for use in concrete. The book consists of 203 pages, 12 chapters and 281 references, plus a bibliography of 53 books, conference proceedings and major reports on the subject of cement and concrete, coal and coal combustion, fly ash and fly ash utilization in concrete.

The author makes the point that national interests, albeit in North America, in the maximum utilization of fly ash, on grounds of energy conservation, environmental protection and economy, can only be met through careful and systematic identification of important ash characteristics and then ensuring that these are achieved in fly ash production.

Chapter 1 deals with the subject of fly ash utilization and both economical and technical aspects are considered. Improved characterisation and rapid test methods for confidently predicting the long-term performance of concrete with fly ash are suggested as ways forward. Chapter 2 is an appropriate addition and deals with the fuel coal and its combustion, ash formation, collection and beneficiation—all very necessary to the understanding of ash characteristics, which are then aptly reviewed in Chapter 3 (composition and particle morphology) and Chapter 4 (physical properties). Chapter 5 discusses the effects of fly ash in freshly mixed concrete, from fundamental

and engineering considerations. The treatment of air entrainment is of particular interest at a time when durability of concrete is itself under the microscope.

The next three chapters deal with the reaction chemistry of Portland cement (hydration), fly ash (pozzolanic) and then of the mixture of cement and fly ash, leading to the porosity and pore structure of hardened mixtures and their microstructure and strength development. The treatment represents a systematic, penetrating study of published literature. Chapter 9 examines fly ash characteristics which affect pozzolanic reactivity, mainly based on strength tests. The author points to the difficulty in predicting concrete properties from the observed effects of ash characteristics on hydrating concrete—this is somewhat misleading as there are some investigations (not reviewed in this book) which suggest the contrary. In Chapter 10 several chemical methods to assess the reactivity of fly ash have been described. However, it is not clear if any of these tests are of any more than academic interest or whether they can be employed to effectively rank fly ashes for use in concrete, any better than they can be ranked by some of the strength tests. The penultimate chapter considers several important aspects of durability with the subjects of sulphate attack and alkali-aggregate reaction control taking the lion's share of the coverage. Although

the diffusion of chloride ions has been briefly reviewed, the subject of carbonation has been sadly omitted. The final Chapter 12, entitled 'Summary' is just that and is very well composed. Important findings of this entire review work on fly ash and its use in concrete are stated, linking them to the engineering properties and durability of concrete. Some of the underlying prob-

lems in this respect have been raised and areas of future research identified, as well as suggestions to ensure good performance of concrete containing fly ash.

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Earthquake resistant design for engineers and architects

Second Edition

David J. Dowrick

Chichester, New York, Brisbane, Toronto, Singapore, John Wiley & Sons, Second Edition 1987. 227 × 149 mm. pp. xix, 519. Typeset, illustrated, hardback. ISBN 0 471 91503 3. Price £28.50.

The first edition of David Dowrick's book, published over ten years ago, has established itself as a standard reference for designers trying to come to terms with the multifarious problems of earthquake engineering. One of the attractions of the book, retained in this revised and expanded second edition, is that almost all aspects of the subject are touched on, from seismology and statistical hazard analysis to the mundane details of pipework supports. Between publication of the two editions, there have been many important developments in almost all these aspects, and this is reflected in the contents of the new edition.

The material specifically on reinforced concrete occupies 90 out of the 519 pages. The discussion covers in situ frame and shear wall structures, with special emphasis on the quantification of ductility. It describes the detailing of in situ superstructures, foundations and retaining walls, and includes a set of standard reinforcement detail drawings (not revised from the first edition). There is also a shorter section on precast concrete structures and cladding, including a useful discussion of connection details, and there is a brief section on prestressed concrete. Sixty three references are cited in the chapter on concrete, and there is an appendix on specifications for reinforcing steel in earthquake resistant structures.

At the start of his chapter on concrete structures, David Dowrick states: "In the mid-1980's an internationally valid state-of-the-art review for resistance of concrete was exceptionally difficult to write, partly because of large differences in attitude in different countries towards certain aspects of design". One can sympathise with the author's problem; the best current American approach, in ACI 318-83⁽¹⁾, is to some extent empirical and even illogical, while the theoretically far superior 'capacity design' approach of the New Zealand code, the author himself admits, as a native of those islands, "is impractical to apply in

all but the simplest cases" in the full rigour outlined by NZA 3101⁽²⁾. As a result, although the basic principles are covered clearly, a well defined practical strategy for the designer does not really emerge from the book. Perhaps the answer to the problem will come not from New Zealand or the States, but from Europe, where the recent CEB seismic code⁽³⁾ (published too late for reference in the book) represents a significant step forward, and where Eurocode 8⁽⁴⁾, for structures in seismic regions, which is still in unpublished draft, is expected to carry the process still further.

Other parts of the book cover basic seismology, seismic hazard assessment, seismic analysis, site response and soil-structure interaction, choice of earthquake resistant form, and material and foundation design. There are separate chapters on design of steel, concrete, timber and masonry structures as well as on equipment and services design and on architectural detailing. There are short sections in the appendix on bridges, chimneys and towers, low rise buildings and the repair and strengthening of existing buildings.

REFERENCES

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2. STANDARDS ASSOCIATION OF NEW ZEALAND. *Code of practice for the design of concrete structures*. NZS 3101, Parts 1 and 2, 1982.
3. COMITE EURO-INTERNATIONAL DU BETON (CEB). *Seismic design of concrete structures*. Aldershot, Gower Technical Press, 1987.
4. COMMISSION OF THE EUROPEAN COMMUNITIES. *Eurocode 8: Structures in seismic regions*. Brussels, Final draft due for publication winter 1988.

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