

Book Reviews

Minimum requirements for durable concrete

Edited by D. W. Hobbs

British Cement Association, Berks, 1998, 172 pp, ISBN 0 7210 1524 7

This book is aimed at practitioners in all sectors of the concrete construction industry and in considering concrete durability for the new European Standards is very timely. It is presented, both in terms of its text and illustrations, in a simple, ready-to-use way and in addition to providing a valuable tool in the process of material selection and specification for concrete, it will also be of value to those undergoing education/training.

Detailed coverage of the provisions necessary to ensure durability in concrete structures is given within the frameworks of the European cement (EN 197) and concrete (EN 206) standards. It is recognised that these are developing documents and the approaches that they use include materials and exposure classifications with which UK practice is not familiar and hence may give difficulties on their introduction.

The book is a co-production of the British Cement Association and the Building Research Establishment and is written by well-known research personnel with significant experience in the durability area. It is divided into five chapters and includes approximately 250 references, and at a total length of 172 pages is comfortable in size. The main cement materials considered include, PC, limestone, PFA, GGBS and silica fume. Deterioration processes described include carbonation-induced corrosion, chloride-induced corrosion, freeze–thaw attack and chemical attack, each receiving a single chapter. An author and subject index help locate areas of interest, while the references, being placed at the end of each chapter, are kept self-contained.

In attempting to offer guidance, consideration is given to relevant UK and overseas laboratory and field data. These are rigorously analysed against the exposure classes within the European concrete standard and mater

ial requirements for minimum periods of service life proposed. Disappointingly, the book does not, to any

great extent, question the prescriptive philosophy behind the durability specifications as they stand, or look ahead to where durability specifications may go, and to this end could have been more thought-provoking. Attempts at quantifying service life through material selection for each process, particularly in relation to initiation and propagation stages of corrosion, are valuable. In providing the evidence, in literature review format alongside the recommendations, it is easy for the reader to check their validity and establish appropriateness to the particular case where the guidelines are being applied.

Chapter 1 provides an introduction, by considering the development of European Standards for both cement and the exposure classes appearing within the UK annex to EN 206. In both cases, reference is made to the related British Standards, so that the reader can see the direction that coverage of these issues within the new standards is taking. Arguably, more background information on why the specifications have developed in this way would allow the reader to appreciate why these changes have taken place, rather than just accept them at face value.

Chapters 2 to 5 focus in turn on the various forms of deterioration. Each starts by providing brief summaries of the mechanisms associated with the form of damage. Reference is made to the specific durability requirements of the appropriate British and European concrete standards. Attempts are also made to quantify the extent of the problem within UK practice and relevant major studies are cited. These are accompanied by illustrative photographs.

The supporting literature considering data relevant to each of the exposure conditions is very well described, with the sections divided appropriately in relation to the cement types considered in EN 197. The data presented represent a good blend of studies that are looked at both individually and collectively. On the

whole, in arriving at minimum requirements for durable concrete in relation to exposure conditions, the book gives clear statements of assumptions made and discussion of the important technical issues. The uncertainty of the role of minimum cement content in specification for durability, as highlighted in the carbonation chapter and the subject of Concrete Society and other investiga-

tions, should perhaps have received coverage elsewhere in the book.

The book represents an excellent body of information, is reasonably priced and should equip all those involved with the necessary information for implementation of the new European Standards.

R. K. DHIR

Waste materials used in concrete manufacturing

Edited by S. Chandra

Noyes Publications, New Jersey, 1997, 651pp, ISBN 0 8155 1393 3

The recycling of waste materials and industrial by-products in concrete construction is now, for many materials, an established practice. However, the materials available and the approach to recycling vary from country to country depending on geographical factors, industrial status and economy, and it is common for books on the subject to address the issue from the point of view of a single nation. It is, therefore, refreshing to see a publication which reviews the advances made in using waste materials in concrete from a range of national perspectives. The book brings together 18 contributors from around the world to review the present understanding of the subject. Whilst not explicitly stated, the general approach would appear to be to bring together research from the widest possible range of sources (in geographical terms) as possible. The 651 page book not only does an excellent job of addressing the current situation with regards to the recycling of the 'classic' industrial by-products such as fly ash, ground granulated blastfurnace slag and silica fume, but also highlights some of the less well-known, but potentially highly useful, waste materials which arise across the globe.

In terms of established materials, Aimin Xu's review of fly ash use in concrete, along with Talling and Krivenko's chapter on ground granulated blastfurnace slag are both excellent starting points for engineers wishing to gain understanding of the vast quantity of work conducted in these areas of research. However, of particular note is Mullick's chapter on the use of lignin-based products from the wood industry as a plasticising agent in concrete. After introducing the sources from which lignin-based materials are derived, the review examines, from a fundamental point of view, the manner by which surfactant molecules act to modify the rheological properties of concrete and how the nature of molecules such as lignosulfonates influence this process. The issues of cement hydration chemistry and fresh and hardened concrete properties are then addressed before dealing with durability properties. Also impressive in terms of its comprehensive approach, is the chapter on silica fume.

The recognition of the need to minimise the release of sulfur dioxide into the atmosphere has led to the extensive use of exhaust gas scrubbing technologies, which frequently generate large quantities of calcium sulfate compounds. The use of these materials, as well as calcium sulfate produced as a by-product of phosphoric acid manufacture, both as plaster and as the set-controlling component in Portland cement are reviewed. The need to reduce acidic pollutant emissions is also one of the reasons why the use of fluidized-bed technology in the generation of electricity from coal combustion is becoming more common. The mineralogy and chemical composition of the ash generated differs significantly from that of fly ash from traditional plants, particularly in terms of the higher sulfate content. Whilst this presents a number of problems for concrete recycling, the first chapter describes a number of methodologies for overcoming such obstacles.

Possibly the best chapter is Uchikawa and Hanehara's study of the use of waste material as both fuel and feed in the cement kiln. As well as carefully examining the complex chemistry involved in such processes, detailed consideration is given to both the control of cement quality as well as minimising environmental impact through kiln operation and pollution prevention technologies. The fact that this chapter alone cites over 120 references makes it possibly the most comprehensive review of the subject to date.

Other materials which are covered by the book include red mud, rice husk ash and palm oil shell. By limiting the size of such a publication to just one volume there will inevitably be much detail omitted, but the role of such a book is not to cover every aspect, but to act as starting point which will direct the reader to the most pertinent sources of information and then on to further, more specialised work. In this capacity, '*Waste Materials Used in Concrete Manufacturing*' is an ideal resource for engineers new to the field and experts alike.

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