

Review



This comprehensive work will be essential reading for anyone researching or undertaking a major study in the area, concludes **Paul Jackson**, with the sections on restraint-induced cracking likely to be of most interest to designers.

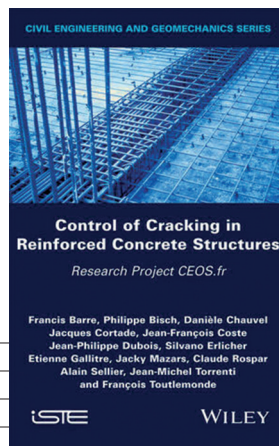
Control of cracking in reinforced concrete structures

Authors: Francis Barre, Philippe Bisch, Daniele Chauvel *et al.*

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"THIS BOOK REPORTS A VERY MAJOR STUDY AIMING TO BE USEFUL TO PRACTISING ENGINEERS"

This book is the culmination of a major study undertaken by various institutions in France from 2008 to 2015. It is a comprehensive study of control of cracking, covering both restraint-induced and structural cracking. It does not cover the long-debated subject of how important crack widths are and assumes they are important to durability.

While a recent very thorough review by the Concrete Society did indeed conclude that cracking was significant to reinforcement corrosion, this is not as conclusive as it may appear. First, it was found to be 'significant' in the essentially statistical sense rather than engineering sense. It is perhaps 95% or 99% certain it has an effect, but the effect is still small compared with the effect of other key factors, notably concrete cover and quality.

Second, it was found that a larger number of narrower cracks could be worse than a small number of wider cracks, even when the total width was less. This implies that the standard crack control approach of using smaller bars at closer centres to induce more, but narrower cracks may be counterproductive.

Nevertheless, crack width control is required if only for aesthetic reasons and this book reports a very major study aiming

to be useful to practising engineers.

The study is so comprehensive and wide-ranging that the work will be essential reading for anyone researching or undertaking a major study in the area. It covers hydration effects, cracking of ties, beams and walls, minimum reinforcement, concrete properties, numerical models and measurements.

The book notes that EN 1992 (Eurocode 2) coverage of restraint-induced cracking in massive elements is inadequate and the work reported is likely to have some considerable influence on the proposed new section for this.

The chapters on structural cracking do present some new insight. However, although certainly imperfect, current code rules are generally adequate without adversely affecting cost significantly. It is therefore the sections on restraint-induced cracking that are more likely to be of interest to designers.

UK readers may be surprised by lack of reference to CIRIA publication *C660 Early-age thermal cracking in concrete*, which has become the standard reference here, although it is only fair to note that C660 probably also underuses French references.

With UK clients for the type of structures where such effects are important often requiring design to CIRIA C660, this may limit the use of the book in practice in the UK, although some of the information could be used in combination with C660, which is itself currently under revision.

One particularly interesting aspect covered is scale effect. Due to random variation, the effective tensile strength which should be used for determining minimum required steel area reduces significantly with scale. Weibull theory is shown to predict this well and figures are given which could be beneficial in design of minimum steel in large concrete pours.

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Paul Jackson worked for a consultant, a contractor and the Cement and Concrete Association, before joining Gifford, now Ramboll, in 1988 where he is a Technical Director. He has worked on design, construction and research, mainly on heavy structures including bridges, as well as extensively on existing structures. He serves on several code committees.