

CIRIA GUIDE C766: AN OVERVIEW OF THE UPDATED CIRIA C660 GUIDANCE ON CONTROL OF CRACKING IN REINFORCED CONCRETE STRUCTURES

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Abstract

This paper provides a brief overview of the updated version of the CIRIA C660 guide on control of thermal cracking, which has been used extensively in the UK and is also popular across Europe. The updated guide is entitled CIRIA C766 – Control of cracking caused by restrained deformation in concrete. It aims towards designing reinforced concrete structures subjected to restrained thermal and shrinkage deformations in a more efficient and sustainable manner, as well as less conservatively while maintaining an adequate degree of safety.

The primary updates present a design approach more closely aligned with BS EN 1992-1-1+A1:2014 and BS EN 1992-3:2006. Revisions include limiting cracking widths, calculation of restraint considering early age and long-term effect and viscoelasticity, models to predict temperature histories of concretes containing mineral additions, as well as a more sustainable selection of parameters relevant to the estimation of crack inducing strains and minimum steel required to control crack widths. Nonetheless, there are still aspects of design that may have not been adequately addressed, potentially requiring further improvements.

Keywords: Early age/Long term cracking, crack control, restraint, thermal and shrinkage cracking

1. INTRODUCTION

Cracking due to restrained volumetric changes in reinforced concrete (RC) structures has long been a recognised problem. This cracking occurrence is predominately associated with imposed deformations due to thermal and shrinkage (autogenous and drying) related effects, at both early ages and long-term, and it is often desired to control them in terms of the resulting crack width [1]. The primary reasons that crack control in RC structures is of great importance for the serviceability limit state design quoted in C766 are: a) ensuring adequate durability of concrete depending on exposure conditions throughout a specified design service life, b)

Ciria Guide C660

Thomas Dyer



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Structural Concrete, Volume 3 fib Fédération internationale du béton, 2009 The second edition of the Structural Concrete Textbook is an extensive revision that reflects advances in knowledge and technology over the past decade It was prepared in the intermediate period from the CEP FIP Model Code 1990 MC90 to fib Model Code 2010 MC2010 and as such incorporates a significant amount of information that has been already finalized for MC2010 while keeping some material from MC90 that was not yet modified considerably The objective of the Textbook is to give detailed information on a wide range of concrete engineering from selection of appropriate structural system and also materials through design and execution and finally behaviour in use The revised fib Structural Concrete Textbook covers the following main topics phases of design process conceptual design short and long term properties of conventional concrete including creep shrinkage fatigue and temperature influences special types of concretes such as self compacting concrete architectural concrete fibre reinforced concrete high and ultra high performance concrete properties of reinforcing and prestressing materials bond tension stiffening moment curvature confining effect dowel action aggregate interlock structural analysis with or without time dependent effects definition of limit states control of cracking and deformations design for moment shear or torsion buckling fatigue anchorages splices detailing design for durability including service life design aspects deterioration mechanisms modelling of deterioration mechanisms environmental influences influences of design and execution on durability fire design including changes in material and structural properties spalling degree of deterioration member design linear members and slabs with reinforcement layout deep beams management assessment maintenance repair including conservation strategies risk management types of interventions as well as aspects of execution quality assurance formwork and curing The updated Textbook provides the basics of material and structural behaviour and the fundamental knowledge needed for the design assessment or retrofitting of concrete structures It will be essential reading material for graduate students in the field of structural concrete and also assist designers and consultants in understanding the background to the rules they apply in their practice Furthermore it should prove particularly valuable to users of the new editions of Eurocode 2 for concrete buildings bridges and container structures which are based only partly on MC90 and partly on more recent knowledge which was not included in the 1999 edition of the Textbook [ICE Handbook of Concrete Durability](#) Marios Soutsos, 2023-10-24 ICE Handbook of Concrete Durability second edition is a comprehensive practical reference for professionals involved in design and maintenance of concrete structures of all types It is an invaluable guide for construction professionals including design engineers consultants and contractors as well as postgraduate students **Control of Cracking in Reinforced Concrete Structures** Francis Barre, Philippe Bisch, Daniele Chauvel, Jacques Cortade, Jean-François Coste, Jean-Philippe Dubois, Silvano Erlicher, Etienne Gallitree, Pierre Labbé, Jacky Mazars, Claude Rospar, Alain Sellier, Jean-Michel Torrenti, François Toutlemonde, 2016-08-16 This book presents new guidelines for the

control of cracking in massive reinforced and prestressed concrete structures Understanding this behavior during construction allows engineers to ensure properties such as durability reliability and water and air tightness throughout a structure s lifetime Based on the findings of the French national CEOS fr project the authors extend existing engineering standards and codes to advance the measurement and prediction of cracking patterns Various behaviors of concrete under load are explored within the chapters of the book These include cracking of ties beams and in walls and the simulation and evaluation of cracking shrinkage and creep The authors propose new engineering rules for crack width and space assessment of cracking patterns and provide recommendations for measurement devices and protocols Intended as a reference for design and civil engineers working on construction projects as well as to aid further work in the research community applied examples are provided at the end of each chapter in the form of expanded measurement methods calculations and commentary on models

Temperature Development in Early Age Concrete Elements Yunus Ballim,2025-09-23 The focus of this book is to provide guidance on the prediction of time temperature profiles in large concrete elements during the early stages of construction with a view to minimising the likely damage that may occur to the concrete as a result of elevated temperatures caused by the heat of hydration of the cementitious materials Early age elevated temperatures in concrete elements create the potential for cracking of the structure as well as compromising the strength and durability of the concrete The book provides details on the characteristics of cementitious materials and their effects on the rate of heat evolution as well as the effects of elevated curing temperatures on the physical mechanical and durability properties of concrete The book also considers the effectiveness of materials selection and construction methodologies for early age concrete temperature management and control Several case studies are presented to illustrate the important aspects in the design and construction of temperature sensitive concrete structures This book is primarily aimed at practicing design and construction engineers who are concerned with thermal effects and stresses in large concrete elements It is also aimed at researchers and postgraduate students who may consider aspects of this wonderfully complex matter of heat transfer and temperature prediction in large concrete structures as sufficiently interesting to warrant further research and investigation

International RILEM Conference on Early-Age and Long-Term Cracking in RC Structures Fragkoulis Kanavaris,Farid Benboudjema,Miguel Azenha,2021-05-18 This volume gathers the latest advances innovations and applications in the field of crack control in concrete as presented by leading international researchers and engineers at the International RILEM Conference on Early age and Long term Cracking in RC Structures CRC 2021 held in Paris France on April 9 2021 It covers early age and long term imposed deformations in concrete analytical formulations for calculating crack widths in concrete numerical simulations of early age and long term restrained behaviour of concrete elements experimental investigations on cracking on site monitoring of imposed deformations and cracking crack control and repair and sustainability of design and remediation The conference demonstrated that a comprehensive approach to this problem requires the design of robust

experimental techniques the development of multiscale models and the evaluation of code based and other analytical approaches relevant to crack control in concrete The contributions which were selected through a rigorous international peer review process share exciting ideas that will spur novel research directions and foster new multidisciplinary collaborations

Concrete Durability Thomas Dyer,2014-05-01 Written specifically for the young professional and addressing a growing need for a long service life with minimal maintenance Concrete Durability takes a whole new look at the whole life performance of structures This text examines physical and chemical issues that can threaten the durability of concrete It explores available options for achieving
Immersed Tunnels Richard Lunniss,Jonathan Baber,2013-03-04 Immersed tunnels have been around for more than a century but remain a relatively unknown form of tunnel construction For waterway crossings they are an effective alternative to bored tunnels and bridges particularly in shallower waters soft alluvial soils and earthquake prone areas Successful implementation requires a thorough understanding of a wide variety of civil engineering disciplines and construction techniques Immersed Tunnels brings together in one volume all aspects of immersed tunnels from initial feasibility and planning through design and construction to operation and maintenance Get Valuable Insights into Immersed Tunnel Engineering from Expert Practitioners The book presents design and construction principles to give a full appreciation not only of what is involved in an immersed tunnel scheme but also how potential problems are dealt with and overcome It examines important factors that have to be considered particularly environmental implications and mechanical and electrical systems It also gives practical examples of how specific techniques have been used in various projects and highlights issues that designers and constructors should be aware of In addition the book discusses operation and maintenance and reviews contractual matters These aspects are described from the viewpoint of two experienced practitioners in the field who have a wealth of experience on immersed tunnel projects worldwide As tunnels are increasingly being adopted as engineering solutions around the world this unique and extensively illustrated reference explores the wide variety of immersed tunnel techniques available to designers and constructors It provides essential insight for anyone involved or seeking to be involved with immersed tunnel projects *Proceedings fib Symposium in Copenhagen Denmark*
FIB - International Federation for Structural Concrete,2015-05-01 Sustainable Buildings Amjad Almusaed,Asaad Almssad,2018-07-18 This book has been written to represent the efficient applications of sustainability upon building designs The book intends to illustrate various techniques of action of sustainability on building conceptions The book is divided into four parts and eight chapters Part I Introduction into Target Theme includes a chapter with title Introductory Chapter It makes an overview of the meaning and the target of sustainable building and sustainable building material Part II Sustainable Building Design Process and Management discusses many forms and concepts of sustainable building and includes three chapters Part III Sustainable Building by Using Energy Efficiency in Building Design includes one chapter Part IV Sustainability in Building Materials Study Cases includes three chapters **Concrete Petrography** Alan Poole,Ian

Sims, 2016-12-19 This classic reference has established the value of petrography as a powerful method for the investigation of concrete as a material. It provides an authoritative and well illustrated review of concrete composition and textures including the causes of defects, deterioration and failure that can be identified using a petrological microscope. This new edition is entirely revised and updated and also greatly extended to take account of new scientific developments and significant improvements in instrumentation and to reflect current laboratory working practices as well as to reflect new understanding of the performance of concrete and related materials. Now in full color throughout. Concrete Petrography Second Edition provides case study examples with appropriate explanatory discussions and practical advice on selecting, handling and preparing specimens. It assists and guides the engineer, the trainee and the experienced petrographer in understanding the scientific evidence that is basic to petrographic analysis and so will lead to more accurate and timely diagnosis and treatment of problems in structural concrete. This book includes Contributions in specialist areas by internationally recognized experts. Explanation of computer techniques as an aid to petrography. Full coverage of inspection, sampling and specimen preparation. New sections covering recent technological development of equipment. Guidance on observation of cement and concrete mineralogy and microfabrics. Discussion and illustrative examples of deterioration and failure mechanisms. New work and guidance on the determination of water/cement ratio. New color illustrations and micrographs throughout. Thorough updating of standards, other authoritative publications and references. A fully revised, extended and updated glossary of optical and other properties.

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