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Briefing

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Briefing: Ciria guide C760: guidance on embedded retaining wall design

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This paper details key aspects of the update of the Construction Industry Research and Information Association's good practice on embedded retaining walls (C760). The authors of C760 provide an overview of the new guidance on the selection and design of vertical embedded retaining walls that satisfy the requirements of Eurocodes. The guidance also covers temporary and permanent cantilevers, and anchored, single-propped and multi-propped retaining walls that are supported by embedment in soft soils, stiff clays and other competent soils and soft rocks. C760 addresses the technical and construction issues relating to the selection of appropriate wall types and construction sequence to achieve a satisfactory design. It clarifies areas of ambiguity and common misunderstandings when applying the Eurocodes to the design of embedded retaining walls and presents a clear, unambiguous method for the application of the observational method.

Notation

E elastic modulus of the reinforcement
 I second moment of area of the reinforced-concrete section
 K_0 in situ earth pressure coefficient, σ'_h/σ'_v

Introduction

An earth-retaining wall is required to withstand forces exerted by a vertical or near-vertical ground surface. An embedded retaining wall is one that penetrates and obtains some lateral support from the ground at its base.

The bending capacity of such a wall typically plays a significant role in the support of the retained material, particularly if it is free-standing. The wall may also be supported by structural members such as props, berms, ground anchors and slabs, and it may form part of a larger structure.

C760 (Gaba *et al.*, 2017) provides guidance on the selection and design of vertical embedded retaining walls in compliance with the principles in the Eurocodes. It covers all types of retaining walls, including sheet pile walls, king post walls, contiguous bored pile walls, secant bored pile walls and diaphragm walls.

It is possible to make economies in embedded retaining walls by selecting an appropriate wall type and support system for the envisaged construction method, construction sequence and long-term use. It is important to adopt a clear, unambiguous design method and to follow appropriate good practice of ground investigation, laboratory and field testing and design analysis, and utilise good-quality case study data. C760 provides guidance on all these points.

Construction Industry Research and Information Association and ground engineering

Whether it is designing and constructing embedded retaining walls for some of the world's most iconic (and not so iconic) infrastructure or designing and constructing levees to protect vulnerable communities from flooding, Construction Industry Research and Information Association's (Ciria) good practice guidance documents are used for a variety of construction and civil engineering schemes.

From everyday construction projects to once-in-a-lifetime major infrastructure schemes, enabling practitioners to design, construct and manage better has been the role of Ciria's research since the inception of the organisation in 1967. The very first research and development work Ciria commissioned was on a series of practical piling guides, leading to the PG Piling series, which became the industry standard for the decades that followed.

Research that Ciria undertakes in the area of ground engineering is steered by the Ciria Ground Engineering Advisory Panel before the wider industry is approached to support its development. Ciria also provides secretariat services to the client-led Geotechnical Asset Owners Forum, which helps position Ciria to identify and develop guidance that meets their particular needs.

Ciria's ground engineering research is a part of Ciria's civil engineering infrastructure programme of good practice guidance research, which is now heavily influenced by the 'digital transformation' and the profound opportunities afforded to the

Ciria Guide 5

Alphose Zingoni



Ciria Guide 5:

Water-resisting Basement Construction Construction Industry Research and Information Association, 1995 This report summarises current best practice and provides guidance on the construction and improvements of water resisting basements It assists architects engineers surveyors and their clients with decision making on the control of the basement's internal environment and the means of construction and maintenance It takes account of viable construction methods for both deep and shallow basements together with the active and passive precautions available to achieve the most appropriate and economic environmental control system Topics covered include internal and external environments design of new basements external drainage positions water and vapour resistance of residential basements refurbishment and upgrading techniques rising groundwater comparison of British design codes example calculations for heating and ventilation and materials

Structural Concrete Textbook, Volume 5 fib Fédération internationale du béton, 2012-06-01 The third 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 for Concrete Structures 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 Beton-Kalender 2018 Konrad Bergmeister, Frank Fingerloos, Johann-Dietrich Wörner, 2018-01-02 Der neue Beton Kalender 2018 mit den Schwerpunkten Bautenschutz und Brandschutz bietet eine solide Arbeitsgrundlage und ein topaktuelles und verlässliches Nachschlagewerk für die fehlerfreie Planung dauerhafter Betonkonstruktionen Dabei geht es um den Schutz vor Betonschäden und den Schutz der Bewehrung um die Sicherstellung der Gebrauchstauglichkeit sowie um die Abwehr von Gefahren für die Umwelt Das Buch stellt den neuesten Stand der Technik der Oberflächenschutzsysteme für verschiedene Anforderungen dar und enthält praxisgerechte Hinweise für die Planung wirtschaftlicher Betonkonstruktionen mit minimalen Instandsetzungskosten und nachhaltig wirksamer Schutzmaßnahmen im Bestand Eine wesentliche Innovationskraft der Betonbauweise besteht in neuen Betonen und in der immer besseren Verarbeitung und Qualitätssicherung wie z B mit dem neuen System der Frischbetonverbundfolie Diese bietet für wasserundurchlässige Betonbauwerke eine zusätzliche Sicherheit bei besonderen und schwierigen Randbedingungen oder bei hohen Nutzungsanforderungen Ihre Anwendung dient der Abdichtung erdberührender Bauteile aber auch z B zum Verkleben von Wärmedämmung auf Außenwänden Zusätzlich werden aktuelle Erläuterungen zur Neuausgabe der DAfStb Richtlinie WU Beton aus erster Hand gegeben Ein Kapitel befasst sich auf aktuellem Stand mit der Bemessung der Schalungssysteme aufgrund von Frischbetondruck Dabei stellen geneigte oder gekrümmte Betonbauteile hohe Anforderungen an die Schalungstechnik und die Bauausführung Ein neues Ingenieurmodell zur Betrachtung der Standsicherheit wird vorgestellt Zum Schwerpunkt Brandschutz wird das Verhalten von Beton unter Brandbeanspruchung grundlegend zusammengefasst Außerdem werden ausführliche Hintergrund Erläuterungen zum konstruktiven baulichen Brandschutz gegeben Für die Hei Bemessung dient eine zusammenfassende Darstellung der wichtigsten bzw gebräuchlichsten Bemessungstabellen aus DIN EN 1992 1 2 mit NA und aus DIN 4102 4 DIN 4102 22 Tabellenverfahren einschließlich Beispielen dem schnellen Zugriff in der Praxis Für die tägliche Berechnungs und Bemessungspraxis wird die nichtlineare Berechnung von Stahlbetonbauteilen und Tragwerken mit Hilfe der FE Methode übersichtlich aufbereitet Dabei wird besonderes Gewicht auf praxistaugliche Hinweise für die Vorbereitung und Durchführung solcher Berechnungen gelegt Die Digitalisierung und der damit verbundene technologische Fortschritt ermöglichen die Einführung von innovativen digital gestützten Methoden und Werkzeugen Vor diesem Hintergrund wird bereits seit einigen Jahren Building Information Modeling BIM als neue Arbeitsmethodik angewandt Es werden die mit der Einführung und Nutzung von BIM verbundenen Themenbereiche und Prozesse bezüglich Technologie Einbindung in das Rechtsgefüge Standardisierung und Zusammenarbeit übersichtlich dargestellt Praxisbeispiele und konkrete Projekterfahrungen verdeutlichen die nutzbringende Anwendung Untersuchungen zur Ermittlung des Ermüdungswiderstandes von Betonbauteilen unter sehr hohen Lastwechselzahlen führten zu neuen Erkenntnissen über die Schädigungsentwicklung die Thematik wird unter

Einbeziehung der Modelle und Bemessungskonzepte grundlegend behandelt Der Beton Kalender 2018 ist wiederum eine besondere Fundgrube für Ingenieure in Planungsbüros und in der Bauindustrie *Examples of the Design of Reinforced Concrete Buildings to BS8110* C.E. Reynolds, J.C. Steedman, 2017-12-21 The latest edition of this well known book makes available to structural design engineers a wealth of practical advice on effective design of concrete structures It covers the complete range of concrete elements and includes numerous data sheets charts and examples to help the designer It is fully updated in line with the relevant British Standards and Codes of Practice **Design and Construction of Joints in Concrete Structures** M. N. Bussell, R. Cather, 1995 This title provides advice on provision specification and construction of joints in in situ concrete construction It aims to help structural designers make informed decisions about the provision of joints in concrete structures **Manual of Numerical Methods in Concrete** M Y H Bangash, 2001-07-27 Manual of numerical methods in concrete aims to present a unified approach for the available mathematical models of concrete linking them to finite element analysis and to computer programs in which special provisions are made for concrete plasticity cracking and crushing with and without concrete aggregate interlocking Creep temperature and shrinkage formulations are included and geared to various concrete constitutive models Rock Mechanics and Engineering Volume 5 Xia-Ting Feng, 2017-07-20 Surface and Underground Projects is the last volume of the five volume set Rock Mechanics and Engineering and contains twenty one chapters from key experts in the following fields Slopes Tunnels and Caverns Mining Petroleum Engineering Thermo Hydro Mechanics in Gas Storage Loading and Radioactive Waste Disposal The five volume set Comprehensive Rock Engineering which was published in 1993 has had an important influence on the development of rock mechanics and rock engineering Significant and extensive advances and achievements in these fields over the last 20 years now justify the publishing of a comparable new compilation Rock Mechanics and Engineering represents a highly prestigious multi volume work edited by Professor Xia Ting Feng with the editorial advice of Professor John A Hudson This new compilation offers an extremely wideranging and comprehensive overview of the state of the art in rock mechanics and rock engineering and is composed of peer reviewed dedicated contributions by all the key experts worldwide Key features of this set are that it provides a systematic global summary of new developments in rock mechanics and rock engineering practices as well as looking ahead to future developments in the fields Contributors are worldrenowned experts in the fields of rock mechanics and rock engineering though younger talented researchers have also been included The individual volumes cover an extremely wide array of topics grouped under five overarching themes Principles Vol 1 Laboratory and Field Testing Vol 2 Analysis Modelling and Design Vol 3 Excavation Support and Monitoring Vol 4 and Surface and Underground Projects Vol 5 This multi volume work sets a new standard for rock mechanics and engineering compendia and will be the go to resource for all engineering professionals and academics involved in rock mechanics and engineering for years to come Schalungsatlas Peter Grupp, 2015-04-15 Wegbereiter für den Siegeszug des Betonbaus war die rasante

Entwicklung der Schalungstechnik in den letzten Jahrzehnten Heute lassen sich mit Beton k hne Bauwerke errichten Der Faktor Schalung beeinflusst dabei die gesamten Baukosten in hohem Ma e Umso erstaunlicher ist es dass dieses Thema in der Literatur kaum Beachtung findet Diese L cke soll nun mit dem Schalungsatlas endg ltig geschlossen werden Als Nachschlagewerk soll es Studierenden und Berufsanf ngern den Einstieg in die Schalungstechnik und den Praktikern den Umgang mit nicht allt glichen Schalaufgaben erleichtern Bewusst wurde deshalb Wert auf Grunds tzliches gelegt praktisch technisch und kaufm nnisch Das Buch zeigt vergleichbare L sungen auf in der Regel mit Hinweisen auf Kosten und Richtzeiten Der Schalungsatlas kann gleicherma en den Studierenden des Bauingenieurwesens als auch denjenigen empfohlen werden die in der Planung und Ausf hrung von Baustellen t tig sind

ICE Manual of Geotechnical Engineering Volume 2 Hilary Skinner,D G Toll,Kelvin Higgins, Mike Brown, John Burland, 2023-11-17 ICE Manual of Geotechnical Engineering Second edition brings together an exceptional breadth of material to provide a definitive reference on geotechnical engineering solutions Written and edited by leading specialists each chapter provides contemporary guidance and best practice knowledge for civil and structural engineers in the field

Prestressed Concrete Bridges Nigel R. Hewson, 2003 Prestressed concrete decks are commonly used for bridges with spans between 25m and 450m and provide economic durable and aesthetic solutions in most situations where bridges are needed Concrete remains the most common material for bridge construction around the world and prestressed concrete is frequently the material of choice Extensively illustrated throughout this invaluable book brings together all aspects of designing prestressed concrete bridge decks into one comprehensive volume The book clearly explains the principles behind both the design and construction of prestressed concrete bridges illustrating the interaction between the two It covers all the different types of deck arrangement and the construction techniques used ranging from in situ slabs and precast beams segmental construction and launched bridges and cable stayed structures Included throughout the book are many examples of the different types of prestressed concrete decks used with the design aspects of each discussed along with the general analysis and design process Detailed descriptions of the prestressing components and systems used are also included Prestressed Concrete Bridges is an essential reference book for both the experienced engineer and graduate who want to learn more about the subject

Basic notes on model uncertainties state of the art report. Liquid and gas tightness of concrete structures progress report FIB – International Federation for Structural Concrete, 1985-02-01

Environmental Handbook for Building and Civil Engineering Projects Roger Venables, 1994 This handbook contains information and practical guidance on the environmental issues likely to be encountered at each stage in the tendering and construction phases of a builidng or civil engineering project It is aimed at informing construcion managers clients designers and other consultants engineers and scientists on their obligations and the opportunities open to them to improve the industrys environmental performance

New Code of Estimating Practice The Chartered Institute of Building, 2018-04-24 The

essential authoritative guide to providing accurate systematic and reliable estimating for construction projects newly revised Pricing and bidding for construction work is at the heart of every construction business and in the minds of construction consultants poor bids lead to poor performance and nobody wins New Code of Estimating Practice examines the processes of estimating and pricing providing best practice guidelines for those involved in procuring and pricing construction works both in the public and private sectors It embodies principles that are applicable to any project regardless of size or complexity This authoritative guide has been completely rewritten to include much more contextual and educational material as well as the code of practice It covers changes in estimating practice the bidding process the fundamentals in formulating a bid the pre qualification process procurement options contractual arrangements and legal issues preliminaries temporary works cost estimating techniques risk management logistics resource and production planning computer aided estimating information and time planning resource planning and pricing preparation of an estimator's report bid assembly and adjudication pre production planning and processes and site production Established standard for the construction industry providing the only code of practice on construction estimating Prepared under the auspices of the Chartered Institute of Building and endorsed by a range of other professional bodies Completely rewritten since the 7th edition to include much more contextual and educational material as well as the core code of practice New Code of Estimating Practice is an important book for construction contractors specialist contractors quantity surveyors cost consultants and for students of construction and quantity surveying

Forensic Engineering Brian S. Neale, 2001 Forensic engineering encompasses any engineering discipline that has the potential to be used for the technical investigation of failures This volume presents papers from leading experts on how to learn from failures of constructed environments from serviceability to catastrophic and on the implications for construction professionals

River Diversions Karen Fisher, David Ramsbottom, 2001 River diversions A design guide covers all aspects of river diversion design including technical construction and legal matters in one concise volume This essential book provides guidance on the design of river diversions taking into account the wide range of issues that must be considered in the planning design and construction Split into four parts this authoritative volume begins with an overall view on the issues to be addressed in river diversion design details of data requirements and outline design procedure

Design of Axially Loaded Piles - European Practice F. De Cock, C. Legrand, 2020-12-17 This book is unique on the subject because it is not so much a collection of individual work but basically comprising national reports from most European countries on the present day design methods as prescribed in more or less strict national codes or recommendations and so daily used in practice by consulting engineers and contractors As far as already implemented the application of these methods within the framework of Eurocode 7 is described as well In order to improve the understanding of the design methods the national papers also consider aspects such as the local piling practice limitations of the design methods some practical examples and particular national experiences The proceedings also include the contributions of two invited

speakers as well as those of the three session discussion leaders focusing on some particular aspects with regards to pile design The book is of particular interest for those who are involved with pile design in practice consulting engineers piling contractors control organisms as well as those dealing with geotechnical normalisation and research work **Concrete**

,1998 *Concrete in Coastal Structures* Richard Thomas Lingen Allen,1998 Describing the nature of the marine environment and the effects of man made structures on the behaviour of the sea this books deals with hydraulic design the material properties of concrete and the design and specification of structures for coastal environments **FOUNDATION**

DESIGN IN PRACTICE GHOSH, KARUNA MOY,2009-03-03 The behaviour of foundation is closely interlinked with the behaviour of soil supporting it This book develops a clear understanding of the soil parameters bearing capacity settlement and deformation and describes the practical methods of designing structural foundations The book analyses the various types of foundations namely isolated footing strip foundation and raft foundation and their structural design It discusses piled foundation the types and behaviour of piles in various soils cohesive and cohesionless and their bearing capacity The book also includes the analysis design and construction of diaphragm wall foundation used in highway and railway tunnels multi storey basement and underground metro stations In addition it includes the analysis and design of sheet piling foundation retaining wall and bridge pier foundation **KEY FEATURES** Demonstrates both BS codes of practice and Eurocodes to analyse soil and structural design of foundations and compares the results Includes a number of examples on foundations Provides structural design calculations with step by step procedures Gives sufficient numbers of relevant sketches figures and tables to reinforce the concepts This book is suitable for the senior undergraduate students of civil engineering and postgraduate students specializing in geotechnical engineering Besides practising engineers will also find this book useful **Current**

Perspectives and New Directions in Mechanics, Modelling and Design of Structural Systems Alphose Zingoni,2022-09-05 *Current Perspectives and New Directions in Mechanics Modelling and Design of Structural Systems* comprises 330 papers that were presented at the Eighth International Conference on Structural Engineering Mechanics and Computation SEMC 2022 Cape Town South Africa 5 7 September 2022 The topics featured may be clustered into six broad categories that span the themes of mechanics modelling and engineering design i mechanics of materials elasticity plasticity porous media fracture fatigue damage delamination viscosity creep shrinkage etc ii mechanics of structures dynamics vibration seismic response soil structure interaction fluid structure interaction response to blast and impact response to fire structural stability buckling collapse behaviour iii numerical modelling and experimental testing numerical methods simulation techniques multi scale modelling computational modelling laboratory testing field testing experimental measurements iv design in traditional engineering materials steel concrete steel concrete composite aluminium masonry timber v innovative concepts sustainable engineering and special structures nanostructures adaptive structures smart structures composite structures glass structures bio inspired structures shells membranes space structures lightweight

structures etc vi the engineering process and life cycle considerations conceptualisation planning analysis design optimization construction assembly manufacture maintenance monitoring assessment repair strengthening retrofitting decommissioning Two versions of the papers are available full papers of length 6 pages are included in an e book while short papers of length 2 pages intended to be concise but self contained summaries of the full papers are in this printed book This work will be of interest to civil structural mechanical marine and aerospace engineers as well as planners and architects

Enjoying the Track of Phrase: An Emotional Symphony within **Ciria Guide 5**

In some sort of used by displays and the ceaseless chatter of instantaneous connection, the melodic elegance and mental symphony produced by the written term frequently disappear in to the background, eclipsed by the relentless noise and distractions that permeate our lives. But, located within the pages of **Ciria Guide 5** a stunning literary value brimming with organic emotions, lies an immersive symphony waiting to be embraced. Constructed by an outstanding musician of language, this fascinating masterpiece conducts viewers on an emotional journey, well unraveling the hidden songs and profound influence resonating within each cautiously crafted phrase. Within the depths of the touching analysis, we shall discover the book is main harmonies, analyze its enthralling publishing design, and surrender ourselves to the profound resonance that echoes in the depths of readers souls.

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