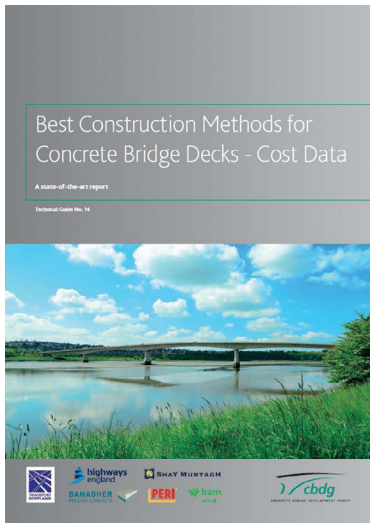
Reviews

This new technical guide provides a useful source of cost data for pricing concrete bridges – particularly formwork and falsework – explains Matthew Myerscough, who has trialled it himself on a recent project.

Best Construction Methods for Concrete Bridge Decks – Cost Data



Author: Simon Bourne
Publisher: Concrete Bridge Development Group
Price: £95.00
ISBN: 978-1-904-48285-6

It has been stated that the twin obligations of a bridge engineer are to use a client's money wisely and to produce a structure for society that will enhance the built environment[1,2]. As the title suggests, this latest publication from the Concrete Bridge Development Group (CBDG) provides guidance on selecting a cost-effective type of concrete bridge deck to help ensure these obligations are satisfied. To make a successful choice, the bridge engineer must have a good appreciation of the construction methods available to place and form the concrete for a new bridge deck, as such practices have a major effect on the final cost of a scheme. However, such knowledge alone is not sufficient, as preliminary schemes can only be compared if they have been reliably priced. It is therefore the intention of this technical guide to provide sufficient cost data to enable the initial pricing of any type and size of concrete bridge.

With a total length of 120 pages, this glossy A4-sized publication is divided into four chapters plus a detailed 50-page appendix. Following a concise introductory chapter, the second chapter contains three sections which cover conceptual, general and particular choice of bridge deck. Conceptual choices include decisions concerning aesthetics, sustainability and durability, while bridge layout, span arrangement and articulation are discussed in the general choices section. Here, the use of reinforced or prestressed concrete is introduced, plus the more unusual partial prestressed bridge form which utilises external cables. While it is not the intention of this guide to describe the merits of pre- and post-tensioned concrete, some basic details are provided. This section concludes by outlining some benefits of high-strength, lightweight and self-compacting concrete, and the importance of good water management through careful detailing.

The final part of chapter two introduces 15 types of concrete bridge deck, which range from *in situ* solid slabs and balanced cantilever bridges, to whole-span precast box girders. In my opinion this section best explains the purpose of the book. On page 26, the reader discovers that while bridge deck quantities can be readily determined and priced, the difficulty with accurate cost prediction lies with pricing the formwork and falsework needed to construct the bridge.

The novel content of the guide is contained within the third chapter, where several pages are dedicated to each of the 15 bridge deck types. A common format for each type includes a summary table, deck description, and typical formwork and falsework rates in £/m^2 for a range of bridge lengths, e.g. 50m, 150m and 600m. These rates include costs relating to casting, transport and erection, and have been published alongside total deck and typical production rates. Usefully, the appendix contains a detailed breakdown of all the summary rates in tabular format, which would allow figures to be adjusted to suit overseas markets. One concern with such a publication is that the cost data are likely to become outdated in the near future. However, it is stated in the guide that a series of indices/factors will be published on the CBDG website in late 2015 so costs can be adjusted pro rata over time.

During my review I read the guide from start to finish in a few days and found the content very readable and not

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Matthew Myerscough is a Bridge Engineer at Cass Hayward. He studied Civil Engineering at University College, Durham, and is currently enrolled on the Bridge Engineering MSc at the University of Surrey. Matthew has a particular interest in long-span structures and won the Institution's Husband Prize in 2014 for his suspension bridge paper.

overcomplicated. It is certainly not the sort of text where the reader becomes saturated with complex concepts and formulae. There is, however, some repetition in the first two chapters, e.g. the parameters affecting the choice of bridge deck are discussed on pages 1, 3 and 17. Most pages are well illustrated with colour photographs or neat hand-drawn diagrams, and the tabulated rates in the appendix are presented clearly. I found the cost data straightforward to use when trialled on a current project, and particularly liked the rules of thumb such as those concerning reinforcement detailing and effective deck thickness on pages 16 and 24 respectively.

Although the guide is intended for professionals, the comprehensive explanation of the range of concrete bridge decks would be useful for students with an interest in the subject. In summary this new technical guide is an excellent addition to the range of publications already available from the CBDG.

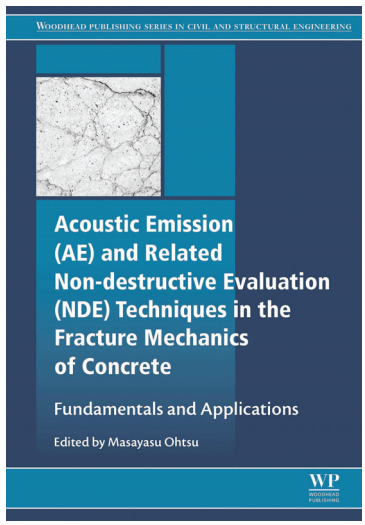
References

► 1) Benaim R. (2008) *The Design of Prestressed Concrete Bridges, Concepts and Principles*, Abingdon, UK: Taylor & Francis

► 2) Bourne S. (2013) 'Prestressing: recovery of the lost art', *The Structural Engineer*, 91 (2), pp. 12–22

This book provides a valuable snapshot of the recent state-of-the-art in this important field, says John Bungey, and will be useful to students, researchers and forward-thinking practising engineers alike.

Acoustic Emission (AE) and Related Non-destructive Evaluation (NDE) Techniques in the Fracture Mechanics of Concrete: Fundamentals and Applications



Editor: Masayasu Ohtsu
Publisher: Woodhead Publishing
Price: £175.00
ISBN: 978-1-782-42327-0

This book comprises 13 chapters based on a specialist conference session held in Spain in 2013, and is edited by a widely recognised international authority in the field. The chapters focus on recent findings related to innovative non-destructive assessment methods associated with fracture mechanics which are under development for concrete, with particular emphasis on acoustic emission (AE). Ultrasonics, X-rays and thermography also feature. The 32 contributors are from a wide range of countries, including Japan, India and the USA, as well as a strong European input – although, sadly, there is no UK participation.

There is a very useful introduction by the Editor explaining the basic principles of AE at an easily understandable level. This includes recommendations for applications to in situ concrete based on recent RILEM work which cover standardisation of measurement, damage quantification and crack classification. The majority of chapters are largely theoretical in nature, dealing with analysis and interpretation of results, supported by laboratory studies. AE testing involves the detection of sudden strain energy release from localised sources, such as crack development, and alternative analysis approaches for use on concrete are discussed and compared.

Some chapters include details of equipment development, while there is a strong emphasis on monitoring situations, including the use of wireless sensing systems. These range from AE detection and classification of earthquake damage, to corrosion of reinforcing and pre-stressing steel, low-level load testing, fire damage and creep effects. The potential for use of artificial neural networks to assist analysis of AE results for corrosion monitoring of post-tensioned concrete is also considered in detail in one chapter, while another describes interesting preliminary studies into thermographic imaging of corroding reinforcing bars. Unfortunately only limited examples are provided of application outside of the laboratory. Among these are laboratory X-ray CT scanning of cores cut from earthquake-damaged concrete for crack visualisation, and AE monitoring of a historic masonry structure during seismic activity, showing clear correspondence of observed data.

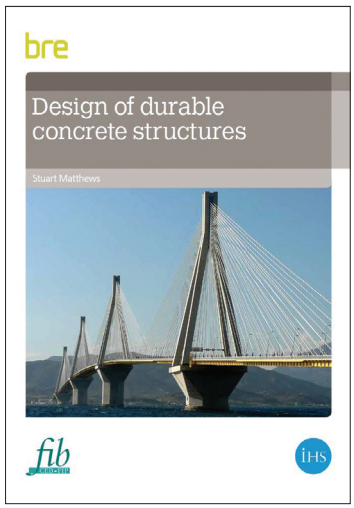
AE has been proposed for testing concrete for many years, and is already an established laboratory tool. This new document contains a wealth of references, both historic and recent, and provides a valuable snapshot of the recent state-of-the-art in an important and ever-developing field. The general standard of content and presentation is high, with relatively little repetition between chapters. The book will be particularly useful for students and researchers, as well as engineers seeking to move innovative research forward from the laboratory into practical on-site applications, including structural health monitoring.

John Bungey
John Bungey is Emeritus Professor of Civil Engineering at the University of Liverpool, and a chartered engineer with more than 40 years of teaching, research and consultancy related to non-destructive testing of concrete. John has published over 150 relevant papers and a textbook on *Testing of Concrete in Structures*. He is a former chair/member of numerous UK and international committees.

Review

Chris Shaw finds this to be a well-presented and useful book, but one that is let down by a series of omissions which he would like to see addressed in the next edition.

Design of durable concrete structures



Author: Stuart Matthews
Publisher: IHS BRE Press
Price: £95.00
ISBN: 978-1-848-06175-0

Concrete is the most widely used structural material around the world, and will continue to be. Most of the concrete used is reinforced concrete and durability is an essential requirement. This book looks at most of the different factors involved in achieving durability, and the text layout is good, as are the photos and figures.

The author draws heavily on *fib* documents, and other published work, and draws attention to the advances in analysis and design which have not been matched by improvements in the knowledge and skills of the construction operatives. Structures are still being built to the lowest initial cost, without regard to their lifetime cost, particularly their durability. The author covers most of the issues involved in the selection of the durability factors, but there is no mention of the political influences or personal preferences of designers, both of which can have a significant influence on the choice of the final design.

It is good to see the "Common Law of Business" reproduced on page 26, as this is all too often overlooked when selecting the successful tender for the work. The inclusion of the "soft" factors (page 8 etc.) is also welcome, as these have a significant effect on the quality of the finished structure, and more attention needs to be paid to them.

The author rightly makes many mentions throughout the book of the problems resulting from the failure to achieve the specified cover to the reinforcement in ordinary steel-reinforced concrete, but fails to make any mention of BS 7973 or the very relevant papers published as part of the Proceedings of the 6th, 7th, and 8th International Conferences on Concrete. This is a serious omission because, as Sections 1.3 and 1.4 explain, the problem of misplaced reinforcement is the single biggest cause of durability problems in ordinary steel-reinforced concrete. There is only one short section (13.10) on this subject, and this has an error in it with regard to the plastic spacer text. The concreting sub-plan (page 372), and reinforcement plan (page 375) are good ideas, but need to specifically include the spacer and chair requirements.

The author makes reference to "negative cover" (page 21), but unlike for other terms in the book, makes no acknowledgement of the originator of the term.

On page 129, three of the four "C"s of concrete are mentioned. It would have been very helpful if the four "C"s of concrete had been included and explained, as they are all equally fundamental to achieving durable concrete structures.

The section that starts on page 278 deals with the use of galvanised reinforcement in some detail. However, there is no mention made of the need to passivate the galvanised reinforcement before it is fixed and the concrete poured. This has been known about for many decades, so it should have been included.

There is a section that deals with corrosion of reinforcement in some detail, but it is disappointing that it does not mention longitudinal cracking of corroded steel reinforcing bars, which can greatly reduce the strength of the structure.

Other terms such as "minimum cover" and "mesh" were discontinued a long time ago and should not have been included in the text, especially "minimum cover", which has resulted in so many of the problems that continue to be seen, even on new structures.

It would have been useful to include a section on flexible detailing as this can overcome many of the problems associated with poor durability due to misplaced and corroding steel reinforcement. Similarly, a section on the use of hybrid reinforcement would have been useful.

This is a potentially useful book, especially with regard to the concrete itself, but users need to be aware of the omissions and errors, which need addressing in the next edition.

Chris Shaw
Chris Shaw is a consultant chartered civil and structural engineer, with several decades of experience in achieving durable concrete, especially reinforced concrete. He is known worldwide for his expertise in developing sustainable reinforced concrete designs, and has written and contributed to many articles and publications on achieving durable reinforced concrete.