Prestressed Concrete Bridges Design And Construction

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The design of structures in general, and prestressed concrete structures in particular, requires considerably more information than is contained in building codes. A sound understanding of structural behaviour at all stages of loading is essential. This textbook presents a detailed description and explanation of the behaviour of prestressed concrete members and structures both at service loads and at ultimate loads and, in doing so, provide a comprehensive and up-to-date guide to structural design. Much of the text is based on first principles and relies only on the principles of mechanics and the properties of concrete and steel, with numerous worked examples. However, where the design requirements are code specific, this book refers to the provisions of Eurocode 2: Design of Concrete Structures and, where possible, the notation is the same as in Eurocode 2. A parallel volume is written to the Australian Standard for Concrete Structures AS3600-2009. The text runs from an introduction to the fundamentals to in-depth treatments of more advanced topics in modern prestressed concrete structures. It suits senior undergraduate and graduate students and also practising engineers who want comprehensive introduction to the design of prestressed concrete structures. It retains the clear and concise explanations and the easy-to-read style of the first edition, but the content has been extensively re-organised and considerably expanded and updated. New chapters cover design procedures, actions and loads; prestressing systems and construction requirements; connections and detailing; and design concepts for prestressed concrete bridges. The topic of serviceability is developed extensively throughout. All the authors have been researching and teaching the behaviour and design of prestressed concrete structures for over thirty-five years and the proposed new edition of the book reflects this wealth of experience. The work has also gained much from Professor Gilbert active and long-time involvement in the development of standards for concrete buildings and concrete bridges.

Since the first prestressed concrete bridge was built and launched by Freyssinet in 1941, such structures have soared to greater heights due to computer-aided design and innovative materials. Rosignoli, a consulting engineer practicing in Italy and abroad, distills aesthetic/environmental conscious design 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.

The design of bridges is a unique art as they are expected to carry moving loads compared to the statically loaded structures. Mere training in code procedures and special design skills are inadequate for successful professional practice. Thorough understanding of basic concepts and response characteristics of various structural elements is necessary for professional bridge designers. This book encompasses the manual and computer aided design of prestressed concrete bridges. Besides explaining the detailed design procedures for designing various components of prestressed concrete girder bridge; this book also focuses on the basic concepts and definitions of various bridge components. The theory of prestressing with its merits and demerits is also discussed in detail. The manual design procedure of different members of prestressed concrete bridges is explained in a comprehensive and step-by-step manner. Illustrations are used to explain the computer aided design method. The design and analysis results are compared in the end and discussions are made in order to explain the reasons for possible discrepancies.

The sixth edition of this comprehensive monograph on Prestressed Concrete is updated to meet the basic requirements of undergraduate and postgraduate students of Civil, Structural and Highway Engineering streams and practising structural engineers. The book incorporates the latest specifications of the revised Indian, British and American codes, with emphasis on the limit state concepts universally adopted in the design of prestressed concrete structures. The design concepts, construction and rehabilitation techniques are well illustrated through numerous worked out examples, figures and case histories of actual structures.

This book was written to make the material presented in my book, Stahlbetonbrucken, accessible to a larger number of engineers throughout the world. A work in English, the logical choice for this task, had been contemplated as Stahlbetonbrucken was still in its earliest stages of preparation. The early success of Stahlbetonbrucken provided significant impetus for the writing of Prestressed Concrete Bridges, which began soon after the publication of its predecessor. The present work is more than a mere translation of Stahlbetonbrucken. Errors in Stahlbetonbrucken that were detected after publication have been corrected. New material on the relation between cracking in concrete and corrosion of reinforcement, prestressing with unbonded tendons, skew-girder bridges, and cable-stayed bridges has been added. Most importantly, however, the presentation of the material has been extensively reworked to improve clarity and consistency. Prestressed Concrete Bridges can thus be regarded as a thoroughly new and improved edition of its predecessor.


Up-to-date coverage of bridge design and analysis—revised to reflect the fifth edition of the AASHTO LRFD specifications Design of Highway Bridges, Third Edition offers...
Prestressed Concrete is a very efficient form of construction; it takes advantage of the strength of concrete in compression. Developed mainly over the second part of the 20th century, prestressed concrete has many advantages including higher strength, increased durability, and improved performance in resisting environmental effects. Initially, prestressed concrete was thought of as an efficient means of economizing materials. In the UK, the Concrete Society report TR47 “Durable Post-tensioned Concrete Bridges” had been published in 1996, which was the culmination of four years of investigations. The report was the result of a Task Group to review their advice note “Guidelines for Grouting” which had first been published in 1990. The merger of FIP and CEB in 1998 brought this under the auspices of fib. Structural deficiencies have only been found in a small number of bridges and in most of these cases the cause is clearly identifiable as either design detailing, workmanship or materials. In the UK, the Concrete Society report TR47 “Durable Post-tensioned Concrete Bridges” had been published in 1996, which was the culmination of four years of investigation.
investigative research, and contained major new specifications and procedures aimed at improving the quality of grouting. In the USA, the Post Tensioning Institute published in 2001 their guide "Specification for Grouting of Post-Tensioned Structures", which also represented major steps forward in materials and testing requirements. The American Segmental Bridge Institute has set up a Committee to re-examine their guidelines, as have many other National Bodies worldwide. In Europe, France has issued a "Fascicule No. 65A" covering requirements for grouting and there are many developments in hand in other countries. Also in Europe, a European Technical Approval Guideline (ETAG) has been published for approval of post-tensioning systems which covers several aspects of grout and grouting. In November 2001 an international workshop was held in Ghent, Belgium on "Durability of Post-Tensioning Tendons" [see fib Bulletin 15] at which international experience was exchanged. The theme was clearly apparent; those bridge owners that have looked, have found some problems with a few of their post-tensioned bridges. In most cases steps are being taken to repair existing bridges, where considered necessary, and to improve future construction by reviewing national specifications. Emphasis is being put on a multi-layer protection strategy whereby protection against corrosion is provided by waterproofing, dense impermeable concrete, sealed ducts and good quality grout. Design detailing and rain water management are seen as important aspects. It was, therefore, timely for fib to publish state-of-the-art guidelines to assist in developing and improving the quality of a major line of defence against corrosion, the cement grout. This document represents a consensus view of current practitioners of what is a rapidly developing awareness of some of the shortcomings of previous practice and suggests improvements. This document is a major update of the previous FIP Guidelines and may be taken as a future basis for updating EN 445-447. New areas include understanding of the deleterious effects of an unstable grout, bleeding and how to avoid it, the importance of training and proper procedures, mix design and testing/trials and some new test procedures. It is now understood and generally accepted that the properties of common grout made from cement and water can be very variable and sometimes unpredictable and such grout is not recommended.

Over 140 experts, 14 countries, and 89 chapters are represented in the second edition of the Bridge Engineering Handbook. This extensive collection highlights bridge engineering specimens from around the world, contains detailed information on bridge engineering, and thoroughly explains the concepts and practical applications surrounding the subject. Published in five books: Fundamentals, Superstructure Design, Substructure Design, Seismic Design, and Construction and Maintenance, this new edition provides numerous worked-out examples that give readers step-by-step design procedures, includes contributions by leading experts from around the world in their respective areas of bridge engineering, contains 26 completely new chapters, and updates most other chapters. It offers design concepts, specifications, and practice, as well as the various types of bridges. The text includes over 2,500 tables, charts, illustrations, and photos. The book covers new, innovative and traditional methods and practices; explores rehabilitation, retrofit, and maintenance; and examines seismic design and building materials. The second book, Superstructure Design, contains 19 chapters, and covers information on how to design all types of bridges. What's New in the Second Edition: Includes two new chapters: Extraduced Bridges and Stress Ribbon Pedestrian Bridges Updates the Prestressed Concrete Girder Bridges chapter and rewrites it as two chapters: Precast/Pretensioned Concrete Girder Bridges and Cast-In-Place Post-Tensioned Prestressed Concrete Girder Bridges Expands the chapter on Bridge Decks and Approach Slabs and divides it into two chapters: Concrete Decks and Approach Slabs Rewrites seven chapters: Segmental Concrete Bridges, Composite Steel I-Girder Bridges, Composite Steel Box Girder Bridges, Arch Bridges, Cable-Stayed Bridges, Orthotropic Steel Decks, and Railings This text is an ideal reference for practicing bridge engineers and consultants (design, construction, maintenance), and can also be used as a reference for students in bridge engineering courses.

Concrete, Structures, Structural design, Structural systems, Design, Bridges, Reinforced concrete, Prestressed concrete
At head of title: National Cooperative Highway Research Program.
Ordinary concrete is strong in compression but weak in tension. Even reinforced concrete, where steel bars are used to take up the tension that the concrete cannot resist, is prone to cracking and corrosion under low loads. Prestressed concrete is highly resistant to stress, and is used as a building material for bridges, tanks, shell roofs, floors, buildings, containment vessels for nuclear power plants and offshore oil platforms. With a wide range of benefits such as crack control, low rates of corrosion, thinner slabs, fewer joints and increased span length; prestressed concrete is a stronger, safer, more economical and more sustainable building material. The introduction of the Eurocodes has necessitated a new approach to the design of prestressed concrete structures and this book provides a comprehensive practical guide for professionals through each stage of the design process. Each chapter focuses on a specific aspect of design Fully consistent with Eurocode 2, and the associated parts of Eurocodes 1 and 8 Examples of challenges often encountered in professional practice worked through in full Detailed coverage of post-tensioned structures Extensive coverage of design of flat slabs using the finite element method Examples of pre-tensioned and post-tensioned bridge design An introduction to earthquake resistant design using EC 8 Examining the design of whole structures as well as the design of sections through many fully worked numerical examples which allow the reader to follow each step of the design calculations, this book will be of great interest to practising engineers who need to become more familiar with the use of the Eurocodes for the design of prestressed concrete structures. It will also be of value to university students with an interest in the practical design of whole structures. Prestressed concrete is widely used in the construction industry in buildings, bridges, and other structures. The new edition of this book provides up-to-date guidance on the detailed design of prestressed concrete structures according to the provisions of the latest preliminary version of Eurocode 2: Design of Concrete Structures, DD ENV 1992-1-1: 1992. The emphasis throughout is on design - the problem of providing a structure to fulfill a given purpose - but fundamental concepts are also described in detail. All major topics are dealt with, including prestressed flat slabs, an important and growing application in the design of buildings. The text is illustrated throughout with worked examples and problems for further study. Examples are given of computer spreadsheets for typical design calculations. Prestressed Concrete Design will be a valuable guide to practising engineers, students and research workers. This handbook for bridge designers replaces earlier publications and introduces the limit state concepts of BS5400, which have now been adopted by the Department of Transport for all concrete bridge
design. Full details of the various standard prestressed concrete beam sections are included and the use of each type of beam in typical superstructures is described.

This report was drafted by fib Task Group 6.4, Precast bridges: José Calavera (Convenor, Spain) André De Chefdiebien (CERIB, France), David Fernández-Ordóñez (Prefabricados Castelo, S.A., Spain, Secretary), Antonello Gasperi (Consulting engineer, Italy), Jorge Ley (INEMAC, Spain), Fritz Mönig (Prof. Bechert & Partner, Germany), Pierre Passerian (CERIB, France), C. Quartel (Spanbeton BV, The Netherlands), Ladislav Sasek (VPU DECO Praha, Czech Republic), George Tootell (Buchan Concrete Ltd., UK), Arnold Van Acker (Belgium)

Methods and practices for constructing sophisticated prestressed concrete structures. Construction of Prestressed Concrete Structures, Second Edition, provides the engineer or construction contractor with a complete guide to the design and construction of modern, high-quality concrete structures. This highly practicable new edition of Ben C. Gerwick's classic guide is expanded and almost entirely rewritten to reflect the dramatic developments in materials and techniques that have occurred over the past two decades. The first of the book's two sections deals with materials and techniques for prestressed concrete, including the latest recipes for high-strength and durable concrete mixes, new reinforcing materials and their placement patterns, modern prestressing systems, and special techniques such as lightweight concrete and composite construction. The second section covers applications to buildings; bridges; piling; and marine structures, including offshore platforms, floating structures, tanks, and containments. Special subjects such as cracking and corrosion, repair, and strengthening of existing structures, and construction in remote areas are presented in the final chapters. For engineers and construction contractors involved in any type of prestressed concrete construction, this book enables the effective implementation of advanced structural concepts and their economical and reliable translation into practice.

Examining the fundamental differences between design and analysis, Benaim explores the close relationship between aesthetic and technical creativity and the importance of the intuitive, more imaginative qualities of design that should be employed by every designer when designing a structure. Aiding designers of concrete bridges in developing an intuitive understanding of structural action, this book thereby encourages innovation and the development of engineering architecture. Simple, relevant calculation techniques that should precede any detailed analysis are summarized. Construction methods.

The 2011 PCI Bridge Design Manual provides preliminary design charts for selecting the girder size and number of prestressing strands for a given span length and beam spacing but only for [smaller f with hook] = 8,000 psi (55.2 MPa). This single strength limits the use of the charts, particularly for states considering ultra-high performance concrete (UHPC). Accordingly, this dissertation presents a simplified procedure to develop preliminary design charts for prestressed concrete bulb-tee girders considering service load stress limits, flexural strength and stresses at release. The results for a BT-72 beam are first compared with the 2003 PCI design charts originally developed based on the AASHTO Standard Specifications. The procedure is then adapted to the AASHTO LRFD Bridge Design Specifications and verified with the prevailing 2011 PCI design charts. Finally, new LRFD charts are generated for NSC, HPC, and UHPC with 0.5, 0.6, and 0.7-in. (13, 15 and 18 mm) strands for simple and two-span continuous bridges to illustrate the simplified procedure and potential impact of UHPC, larger strand size, and continuity on bridge girders. The new LRFD charts are shown to be accurate for the design assumptions made since an excellent agreement (within 2% and 4%) resulted between the preliminary design charts developed in this study and those given in the 2003 and 2011 PCI Bridge Design Manuals. The "transition point" is identified which provides the information needed for a designer to distinguish the zones between fully prestressed (uncracked), partially prestressed, and non-prestressed (cracked) members. The preliminary design charts demonstrate the effect of using UHPC and/or larger strand size and/or two-span continuous layouts. The effect of implementing continuity with the combination of UHPC and a larger strand diameter was shown to be much more significant than just increasing the concrete compressive strength or the strand diameter or using two-span continuous layouts. However, the use of longer full-span girders poses significant challenges for fabrication, transportation, erection, span-to-depth ratios, and live and dead load deflections of prestressed concrete bridges and, consequently, should be considered carefully for the final design of the bridge.