

PRESTRESSED CONCRETE DESIGN



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Praveen Nagarajan

Department of Civil Engineering
NIT Calicut, Kerala

PEARSON

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*To my parents,
Mrs. Rani Nagarajan and Dr N. M. Nagarajan,
and my Teachers at
NIT Calicut and IIT Madras*



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Preface

This book deals with the analysis and design of prestressed concrete members as per the IS: 1343–1980 specification. It is intended to be an easy-to-read textbook for a first course in prestressed concrete design for senior undergraduate and postgraduate students of Civil Engineering. The book will also be useful for practising engineers and help them understand the basis behind the code recommendations.

Spread across 13 chapters, the key features of the book are:

- ❑ The concepts of prestressed concrete design are explained in a simple manner.
- ❑ The contents of each chapter are enhanced with new and better figures for improved understanding.
- ❑ Detailed derivations are presented for almost all equations.
- ❑ The book follows a step-by-step approach for problem solving, with each step explained from first principles.

Chapter 1 explains the behaviour of the prestressed concrete member and introduces the different methods of prestressing and types of prestressed concrete.

The need for high tensile steel and high strength concrete for prestressed concrete structure is brought out in Chapter 2, which also describes briefly some of the important properties of these materials.

The philosophy of limit state design is discussed in Chapter 3. The various sources and methods to evaluate the loss of prestressing force in both pre-tensioned and post-tensioned prestressed concrete members are dealt with in Chapter 4.

Chapter 5 analyzes the behaviour of prestressed concrete member in flexure at both serviceability and ultimate limit state. It elaborates on the different methods to calculate elastic stress distribution in concrete, namely, the combined load approach, the internal couple approach and the equivalent load approach. The chapter also examines the procedures to find the ultimate moment of resistance of both rectangular and flanged sections.

Chapters 6 and 7 examine the design for shear, torsion and anchorage zones. Methods to predict the short term and long term deflections of prestressed concrete beams are elucidated in Chapter 8.

Chapter 9 outlines the procedure to be followed for the design of statically determinate prestressed concrete beams (Type 1 and Type 2 members). The methods of analysis and design of composite members are revealed in Chapter 10.

Chapter 11 gives a brief introduction to the analysis of indeterminate prestressed concrete members. The design of one-way and two-way slabs is delineated in Chapter 12. Finally, Chapter 13 covers the design of prestressed concrete pipes, watertanks and ring beams.

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Comments, feedback and suggestions for the improvement of the book are welcome.

Praveen Nagarajan

About the Author

Dr Praveen Nagarajan is an alumnus of NIT Calicut and IIT Madras. An illustrious student of Civil Engineering throughout his college life, he worked briefly for L&T Ramboll, Chennai, before joining as faculty at NIT Calicut.

Included among Dr Praveen's many areas of interest are reinforced and prestressed concrete, steel structures, bridge engineering, structural reliability and structural dynamics – topics in which he has published numerous technical papers. A recipient of several awards for technical excellence such as the Valli Anantharamakrishnan Merit Prize (2003) from IIT Madras, E P Nicolaides Prize (2009) from the Institution of Engineers (India) and the Best Young Teacher award (for the academic year 2008–2009) from NIT Calicut, he has guided more than 25 M.Tech. projects. Currently Assistant Professor at the Department of Civil Engineering, NIT Calicut, he is also guiding three research scholars to their doctoral degrees.



