Modern fastening technology is becoming increasingly important in civil and structural engineering worldwide. Cast-in-place fastenings, which are placed in the formwork before the concrete is poured, as well as post-installed fastening systems, which are installed in hardened concrete or masonry, have found widespread use in construction practice.

Anchor bolts transfer applied tension loads to the anchorage material through mechanical interlock, friction, bond, or a combination of these mechanisms. Regardless of the load-transfer mechanism, however, fastening systems rely on the tension strength of the concrete or masonry. This fact must be accounted for both in the design of the fastening and the design of the supporting (or supported) concrete or masonry member.

Every fastening element is designed for optimal performance for a specific application. When a fastening element is used for an application for which it was not intended, its performance can be negatively affected. Knowledge of the behaviour of different fastenings is therefore necessary to select the proper fastening system for a given application and to implement the design of the fastening correctly. Fastening behaviour may be influenced by many parameters. Environmental conditions such as chemical attack, temperature fluctuation, and fire exposure must also be considered.

Although each year millions of anchors are installed in concrete and masonry elements on construction sites around the world, the state of knowledge about this technology in the practice is often very poor. It is therefore the goal of this book to present the state of the art relative to fastening technology for concrete. Fastening products currently available on the market, as well as their intended areas of application, are discussed. The fundamentals of their load-bearing behaviour under short- and long-term loading, dynamic loading including seismic loading, and the dependence of the behaviour on the loading direction and failure mode are presented. The influence of the condition of the concrete, non-cracked versus cracked, as well as the behaviour of fastenings under fire loading and the corrosion behaviour of fasteners is examined. Additionally, a detailed discussion of the design of fastenings is provided.

This book builds on the volume ‘Befestigungs-technik in Beton- and Mauerwerk’ by Eligehausen, Mallée (2000) and translated into the English by Philip Thrift (Hannover). Extensive editing of the translated text was performed by John Silva. The content in this book, however, has been significantly extended and updated.

Research in the field of fastening technique from around the world is brought together in this book. Much of this research was conducted at the Department of Fastening Technology at the University of Stuttgart. The department was founded in the 1970’s by Professor Emeritus Dr.-Ing. Dr.-Ing. E.h. (mult) Gallus Rehm and flourished under his oversight until his retirement in 1989. The authors owe him a great deal of gratitude.

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