Mix Design Of Fiber Reinforced Concrete Frc Using Slag

This volume consists of papers presented at the International Conference on Recent Developments in Fibre Reinforced Cements and Concretes, held at the School of Engineering, University of Wales College of Cardiff, UK, 18-20 September 1989.
The leading international authorities bring together in this contributed volume the latest research and current thinking on advanced fiber reinforced cement composites. Under rigorous editorial control, 13 chapters map out the key properties and behaviour of these materials, which promise to extend their applications into many more areas in the com
High Performance Fiber Reinforced Cement Composites 2
Specification and Design of Fiber Reinforced Bridge Deck Forms for Use on Wide Flange T-girders
Fibre Reinforced Cement and Concrete
On Shear Behavior of Structural Elements Made of Steel Fiber Reinforced Concrete
Recent developments
Behavior, Modelling and Design
A reference for shotcrete technologists and practitioners on this method of concrete placement and its great scope for adaptability, optimization, and error. The text assesses laboratory research projects and also focusses on innovative developments in this field.
Surface and Underground Project Case Histories
RheoCon2 & SCC9
1985 Fall Convention, Chicago, Illinois
Study of Shear for Steel Fibre Reinforced Concrete (SFRC) with Ratio 0.15%, 0.25%, 0.35%, 0.45% and 0.55%
HPFRCC 6
Selected Bibliography on Fiber-reinforced Cement and Concrete
Proceedings fib Symposium in Copenhagen Denmark
This book discusses design aspects of steel fiber-reinforced concrete (SFRC) members, including the behavior of the SFRC and its modeling. It also examines the effect of various parameters governing the response of SFRC members in detail. Unlike other publications available in the form of guidelines, which mainly describe design methods based on experimental results, it describes the basic concepts and principles of designing structural members using SFRC as a structural material, predominantly subjected to flexure and shear. Although applications to special structures, such as bridges, retaining walls, tanks and silos are not specifically covered, the fundamental design concepts remain the same and can easily be extended to these elements. It introduces the principles and related theories for predicting the role of steel fibers in reinforcing concrete members concisely and logically, and presents various material models to predict the response of SFRC members in detail. These are then gradually extended to develop an analytical flexural model for the analysis and design of SFRC members. The lack of such a discussion is a major hindrance to the adoption of SFRC as a structural material in routine design practice. This book helps users appraise the role of fiber as reinforcement in concrete members used alone and/or along with conventional rebars. Applications to singly and doubly reinforced beams and slabs are illustrated with examples, using both SFRC and conventional reinforced concrete as a structural material. The influence of the addition of steel fibers on various mechanical properties of the SFRC members is discussed in detail, which is invaluable in helping designers and engineers create optimum designs. Lastly, it describes the generally accepted methods for specifying the steel fibers at the site along with the SFRC mixing methods, storage and transport and explains in detail methods to validate the adopted design. This book is useful to practicing engineers, researchers, and students.
This book presents the latest research development on fibre reinforced cementitious materials, especially those related to ageing and durability. The book forms the Proceedings of the International Symposium held at Sheffield in July 1992, the latest in a series of RILEM symposia on this subject, organised by RILEM Technical Committee 102-AFC Agein
Computer Aided Concrete Mix Design
Concrete Mix Design - III (i) Fibre-reinforced Composites (ii) The Economic Utilisation of Concrete Materials
Proceedings of the International Workshop
Fibre Reinforced Cement and Concretes
State-of-the-Art Report of the RILEM Technical Committee 228-MPS on Mechanical Properties of Self-Compacting Concrete
Development Testing and Analysis of Steel Fiber-reinforced Concrete Mine Support Members
This book gathers the peer-reviewed contributions presented at two parallel, closely interconnected events on advanced construction materials and processes, namely the 2nd International RILEM Conference on Rheology and Processing of Construction Materials (RheoCon2) and the 9th International RILEM Symposium on Self-Compacting Concrete (SCC9), held in Dresden, Germany on 8-11 September 2019. The papers discuss various aspects of research on the development, testing, and applications of cement-based and other building materials together with their specific rheological properties. Furthermore, the papers cover the latest findings in the fast-growing field of self-compacting concrete, addressing topics including components' properties and characterization; chemical admixtures, effect of binders (incl. geopolymers, calcined clay, etc.) and mixture design; laboratory and in-situ rheological testing; constitutive models and flow modelling; numerical simulations; mixing, processing and casting processes; and additive manufacturing / 3D-printing. Also presenting case studies, the book is of interest to researchers, graduate students, and industry specialists, such as material suppliers, consultants and construction experts.
This book envisions the most appropriate design strategies that guarantee the adequate environmental performance of buildings during phases of design and construction as well as use. It focuses on relevant issues related to the production of sustainable buildings and the socio-cultural integration aspects of new architectural designs in urban settings. The book also addresses the design features of historic buildings.
Cement-Based Composites
Steel Fiber Reinforced Concrete
Fibre Reinforced Concrete: Improvements and Innovations II
Concrete Technology
PRO 39: 4th International RILEM Symposium on Fibre-Reinforced Concretes (FRC) - BEFIB 2004 (Volume 1)
Rheology and Processing of Construction Materials
The main objective of this study was to develop a mix design adjustment method for Fiber Reinforced Concrete (FRC) that would maintain appropriate workability while improving hardened concrete performance. A literature review was conducted to examine existing methods for adjusting mix designs to account for fiber introduction. It was found that while increasing fine aggregate and cement paste content can make up for lost workability with the addition of fibers, no rational mix design adjustment method is available. Reference mix designs from the Nevada Department of Transportation and the Nebraska Department of Transportation were used, and this study focused on tailoring the idea of increasing paste and fine aggregate to focus on the parameter of excess paste. Excess paste serves to coat the aggregate particles and is critical for workability. To apply this method of excess paste adjustment, a modified version of ASTM C29 was used to determine the void content of fiber-aggregate skeletons with varying fiber contents. Paste and fine aggregate content were then adjusted to maintain the excess paste quantity between reference mixes and mixes with fiber. A variety of tests including slump, vibrated L-box, compressive strength, splitting tensile strength, flexural strength, drying shrinkage, and restrained shrinkage were conducted to evaluate the overall concrete performance. Results indicated that, for each mix design, adjusting based on excess paste provided a workable FRC with improved hardened performance. Eight slabs were then prepared for a large-scale examination of constructability. Throughout the study of FRC, an alternative concrete to Ultra-High Performance Concrete (UHPC) that would considerably outperform High-Performance Concrete (HPC) was developed. This study delves into the development of a new type of concrete called Super High Performance Concrete (SHPC). SHPC is a high strength, self-consolidating FRC that would significantly cut back on cost and production limitations compared to UHPC as it can be produced with conventional drum-type mixers. Results indicate that SHPC outperforms HPC in matters of workability, compressive strength, flexural strength, and toughness and could potentially be a viable alternative of UHPC for applications such as bridge deck connections and overlays.
Cement-Based Composites takes a different approach from most other books in the field by viewing concrete as an advanced composite material, and by considering the properties and behaviour of cement-based materials from this stance. It deals particularly, but not exclusively, with newer forms of cement-based materials. This new edition takes a critical approach to the subject as well as presenting up-to-date knowledge. Emphasis is given to non-conventional reinforcement and design methods, problems at the materials' interfaces and to the durability of structures. High strength composites and novel forms of cement-based composites are described in detail. After a basic introduction the book explores the various components of these materials and their properties. It then deals with mechanical properties and considers characteristics under various loading and environmental conditions, and concludes by examining design, optimization and economics with particular emphasis on high-performance concretes. Researchers, graduate students and practising engineers will find this book valuable.
Concrete for Tunnel Liners
ACI Convention Seminar for Design with Fiber Reinforced Concrete
Sustainability and Resilience in the Built Environment
Proposal of a Mix Design Method for Low Cement Fiber Reinforced Concrete
Development of a Mix Design Adjustment Method for Fiber Reinforced Concrete and Super High-performance Concrete Based on Excess Paste
Highway Focus
This volume highlights the latest advances, innovations, and applications in the field of fibre reinforced concrete (FRC) and discusses a diverse range of topics concerning FRC: rheology and early-age properties, mechanical properties, codes and standards, long-term properties, durability, analytical and numerical models, quality control, structural and Industrial applications, smart FRC's, nanotechnologies related to FRC, textile reinforced concrete, structural design and UHPFRC. The contributions present improved traditional and new ideas that will open novel research directions and foster multidisciplinary collaboration between different specialists. Although the symposium was postponed, the book gathers peer-reviewed papers selected in 2020 for the RILEM-fib International Symposium on Fibre Reinforced Concrete (BEFIB).
The commercial use of hemp fiber in the construction industry within the United States is non-existent. This lack of use is because of State and Federal laws forbidding the growth of hemp in the United States, which has led to a lack of research. Not having an established supply chain for hemp and coupled with limited research has put the United States behind other countries in finding viable options for these renewable resources. This is a study of the performance of raw hemp fibers and processed hemp twine in a cement past mixture subjected to tensile loading. Three water/cement ratios (0.66, 0.49, 0.42) were considered.
Replacement of cement with fly ash is also part of the program to see if it affects the performance of the system. A detailed description of the method of applying the tensile load to the micro/macro fibers along with the fixture setup is part of this article. The results of this investigation show the hemp twine and fibers will bond to the cement matrix and they can carry higher tensile loads at higher w/c ratios. This study shows that 30 mm embedment length is best for hemp macro fibers and 20 mm embedment for hemp micro fibers. This study also includes a comparative investigation of the performance of hemp fibers to synthetic and steel fibers added to a concrete mix. This investigation examined the compressive strength of the fiber-reinforced concrete mixes, flexural capacity, ductility, flexural toughness and the effects the fibers have on Young's modulus of elasticity. All fibers were introduced to the same mix design (w/c = 0.49) with replacement of 25% of cement with fly ash. Hemp micro fibers at the same dosing rate a synthetic micro fibers has a slightly higher toughness and equivalent flexural strength. Hemp macro fibers at a higher dosing rate as compared to synthetic fibers will have similar toughness and equivalent flexural strength. Steel fibers performed better than the synthetic and natural fibers at 28-day compressive strength..
High Performance Fiber Reinforced Cement Composites 6
Flexural Strength and Fatigue of Steel Fiber Reinforced Concrete (2004 Hale Boggs Deck)
Theory and Practice
X RILEM-fib International Symposium on Fibre Reinforced Concrete (BEFIB) 2021
Fiber Reinforced Cement and Concrete Composites
Design of Cities and Buildings
Concrete, the second most used material in the world, presents great performance and economic benefits. Yet, it is often characterized by a brittle behaviour, low tensile strength, and toughness. Fibers are usually added to concrete to counteract its brittle behaviour, increasing ductility and toughness, controlling crack propagation and delaying concrete failure. However, their addition significantly worsens the fresh state performance of the material. To improve fresh state of the so-called Fiber Reinforced Concrete (FRC), conventional mix-design methods recommend the use of high paste content, which results in a significant increase of Portland cement (PC) content and raises the carbon footprint of the material. The latter is responsible for 8% of the global annual carbon dioxide (CO2) anthropogenic emissions. Given the current worldwide concerns on global warming, the construction industry is in a need to lessen the demand, and thus production of PC. Recent studies have been focusing on the use of advanced mix-design techniques (i.e. particle packing models- PPMs) along with Inert Fillers (IF) as an alternative to reduce PC content in concrete. However, the latter was not applied to conventional FRC. In this work, advanced mix design techniques (i.e. PPMs) are used to overcome the aforementioned issues and mix-proportion eco-efficient FRC with low cement content (
Steel Fibre Reinforced Concrete can be manufactured by adding steel fibre to a concrete mix design. Steel fibres were adding to the concrete in order to get more strength. The concrete grade of 30 N/mm2 was used during the preparation of the concrete mixture for the usage of normal concrete as the control sample and sample with 0.15%, 0.25%, 0.35%, 0.45% and 0.55% of steel fibre in terms of volume. Compression test and flexural test was implemented which was accordance to the ASTM C-39 and ASTM C-78 respectively. Compression test were tested to cube and flexural test were tested to beam sample. The graphs were used to present the result. Shear strength became increased due to the percentages of the steel fibre. If the percentages of steel fibres were high, the shear strength was also high. The highest value of shear strength, 14.47kN is for 0.55 % which is the highest value of steel fibre reinforcement in this study. With mix of concrete design with percentage of steel fibre reinforcement in term of volume, optimum compressive strength for 7 days of curing at 20.07 N/mm2 can be achieved at 0.55% of steel fibre reinforcement. Meanwhile, optimum compressive strength for 28 days of curing at 29.31 N/mm2 can be achieved at 0.15% of steel fibre reinforcement. From this study, the usage of steel fiber in concrete will increase the shear strength of the concrete. That's mean, steel fibre can be use for reduce shear reinforcement in concrete.
Surface and Underground Project Case Histories
RILEM-fib International Symposium on FRC (BEFIB) in 2020
Proceedings of the Fourth RILEM International Symposium
Engineering Developments
Hemp Fiber an Environmentally Friendly Fiber for Concrete Reinforcement
Bibliography of FRA Office of Research and Development Technical Reports, 1974-1980
The State-of-the-Art Report of RILEM Technical Committee 228-MPS on Mechanical properties of Self-Compacting Concrete (SCC) summarizes an extensive body of information related to mechanical properties and mechanical behaviour of SCC. Due attention is given to the fact that the composition of SCC varies significantly. A wide range of mechanical properties are considered, including compressive strength, stress-strain relationship, tensile and flexural strengths, modulus of elasticity, shear strength, effect of elevated temperature, such as fire spalling and residual properties after fire, in-situ properties, creep, shrinkage, bond properties and structural behaviour. A chapter on fibre-reinforced SCC is included, as well as a chapter on specialty SCC, such as light-weight SCC, heavy-weight SCC, preplaced aggregate SCC, special fibre reinforced SCC and underwater concrete.
Concrete design has recently seen a shift in focus from prescriptive specifications to performance based specifications with increasing demands for sustainable products. Fiber reinforced composites (FRC) provides unique properties to a material that is very weak under tensile loads. The addition of fibers to a concrete mix provides additional ductility and reduces the propagation of cracks in the concrete structure. It is the fibers that bridge the crack and dissipate the incurred strain energy in the form of a fiber-pullout mechanism. The addition of fibers plays an important role in tunnel lining systems and in reducing shrinkage cracking in high performance concretes. The interest in most design situations is the load where cracking first takes place. Typically the post crack response will exhibit either a load bearing increase as deflection continues, or a load bearing decrease as deflection continues. These behaviors are referred to as strain hardening and strain softening respectively. A strain softening or hardening response is used to model the behavior of different types of fiber reinforced concrete and simulate the experimental flexural response. Closed form equations for moment-curvature response of rectangular beams under four and three point loading in conjunction with crack localization rules are utilized. As a result, the stress distribution that considers a shifting neutral axis can be simulated which provides a more accurate representation of the residual strength of the fiber cement composites. The use of typical residual strength parameters by standards organizations ASTM, JCI and RILEM are examined to be incorrect in their linear elastic assumption of FRC behavior. Finite element models were implemented to study the effects and simulate the load defection response of fiber reinforced shotcrete round discrete panels (RDP's) tested in accordance with ASTM C-1550. The back-calculated material properties from the flexural tests were used as a basis for the FEM material models. Further development of FEM beams were also used to provide additional comparisons in residual strengths of early age samples. A correlation between the RDP and flexural beam test was generated based a relationship between normalized toughness with respect to the newly generated crack surfaces. A set of design equations are proposed using a residual strength correction factor generated by the model and produce the design moment based on specified concrete slab geometry.
Materials, Mechanical Properties and Performance, Second Edition
Shotcrete
Engineering Properties of Fiber-reinforced and Polymer-impregnated Shotcrete
Concrete Reinforced with Plain and Deformed Steel Fibers
Mix Design and Testing Methods of Fibre Reinforced Concrete
Toughness Based Analysis and Design of Fiber Reinforced Concrete
This volume highlights the latest advances, innovations, and applications in the field of fibre-reinforced concrete (FRC), as presented by scientists and engineers at the RILEM-fib X International Symposium on Fibre Reinforced Concrete (BEFIB), held in Valencia, Spain, on September 20–22, 2021. It discusses a diverse range of topics concerning FRC: technological aspects, nanotechnologies related with FRC, mechanical properties, long-term properties, analytical and numerical models, structural design, codes and standards, quality control, case studies, Textile-Reinforced Concrete, Geopolymers and UHPFRC. After the symposium postponement in 2020, this new volume concludes the publication of the research works and knowledge of FRC in the frame of BEFIB from 2020 to 2021 with the successful celebration of the hybrid symposium BEFIB 2021. The contributions present traditional and new ideas that will open novel research directions and foster multidisciplinary collaboration between different specialists.
Wide-flanged concrete girders are increasingly being used for highway bridges in Wisconsin. The objective of this research was to understand the state of the art of non-metallic SIP forms and to develop design guidelines and performance specifications that can be used locally for the construction of highway bridge decks. Four major types of stay-in-place (SIP) forms using fiber reinforced concrete (FRC) or fiber reinforced polymer (FRP) materials were investigated: fiber reinforcements, grid reinforcements, bar reinforcements and pultruded profiles. The results were used to develop a model design and construction specification for non-structural, non-metallic, SIP forms in highway bridge decks.
Support System Design and Results of Laboratory Investigation and Full-scale Testing
Comprehensive Rock Engineering: Principles, Practice and Projects
Fiber Reinforced Concrete
Fibre Reinforced Concrete: Improvements and Innovations
PRO 15: 5th RILEM Symposium on Fibre-Reinforced Concretes (FRC) - BEFIB' 2000
Mechanical Properties of Self-Compacting Concrete
High Performance Fiber Reinforced Cement Composites (HPFRCC) represent a class of cement composites whose stress-strain response in tension undergoes strain hardening behaviour accompanied by multiple cracking, leading to a high strain prior to failure. The primary objective of this International Workshop was to provide a compendium of up-to-date information on the most recent developments and research advances in the field of High Performance Fiber Reinforced Cement Composites. Approximately 65 contributions from leading world experts are assembled in these proceedings and provide an authoritative perspective on the subject. Special topics include fresh and hardening state properties; self-compacting mixtures; mechanical behavior under compressive, tensile, and shear loading; structural applications; impact, earthquake and fire resistance; durability issues; ultra-high performance fiber reinforced concrete; and textile reinforced concrete. Target readers: graduate students, researchers, fiber producers, design engineers, material scientists.
This book sheds light on the shear behavior of Fiber Reinforced Concrete (FRC) elements, presenting a thorough analysis of the most important studies in the field and highlighting their shortcomings and issues that have been neglected to date. Instead of proposing a new formula, which would add to an already long list, it instead focuses on existing design codes. Based on a comparison of experimental tests, it provides a thorough analysis of these codes, describing both their reliability and weaknesses. Among other issues, the book addresses the influence of flange size on shear, and the possible inclusion of the flange factor in design formulas. Moreover, it reports in detail on tests performed on beams made of concrete of different compressive strengths, and on fiber reinforcements to study the influence on shear, including size effects. Lastly, the book presents a thorough analysis of FRC hollow core slabs. In fact, although this is an area of great interest in the current research landscape, it remains largely unexplored due to the difficulties encountered in attempting to fit transverse reinforcement in these elements.
Mix Design Recommendations for Prototype Extruded Liner System