Mix Design Of Fiber Reinforced Concrete Frc Using Slag

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 is mainly based on the results of the EU-funded UE-FP7 Project EnCoRe, which aimed to characterize the key physical and mechanical properties of a novel class of advanced cement-based materials incorporating recycled powders and aggregates and/or natural ingredients in order to allow partial or even total replacement of conventional constituents. More specifically, the project objectives were to predict the physical and mechanical performance of concrete with recycled aggregates; to understand the potential contribution of recycled fibers as a dispersed reinforcement in concrete matrices; and to demonstrate the feasibility and possible applications of natural fibers as a reinforcement in cementitious composites. All of these aspects are fully covered in the book. The opening chapters explain the material concept and design and discuss the experimental characterization of the physical, chemical, and mechanical properties of the recycled raw constituents, as well as of the cementitious composite incorporating them. The numerical models with potentialities for describing the behavior at material and structural level of constructions systems made by these composites are presented. Finally, engineering applications and guidelines for production and design are proposed.

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.

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.

Development of a Mix Design Adjustment Method for Fiber Reinforced Concrete and Super High-performance Concrete Based on Excess Paste

Your timely source for more cost-effective and less disruptive solutions to your underground infrastructure needs. The North American Tunneling Conference is the premier biennial tunneling event for North America, bringing together the brightest, most resourceful, and innovative minds in the tunneling industry. It underscores the important role that the industry plays in the development of underground spaces, transportation and conveyance systems, and other forms of sustainable underground infrastructure. With every conference, the number of attendees and breadth of topics grow. The authors—experts and leaders in the industry—share the latest case histories, expertise, lessons learned, and real-world applications from around the globe. Crafted from a collection of 126 papers presented at the conference, this book takes you deep inside the projects. It includes challenging design issues, fresh approaches on performance, future projects, and industry trends as well as ground movement and support, structure analysis, risk and cost management, rock tunnels, caverns and shafts, TBM technology, and water and wastewater conveyance.

Volume is indexed by Thomson Reuters CPCI-S (WoS). This book aims to collect the latest development and applications of advanced and sustainable materials, the innovation in civil and hydraulic engineering, the innovation in architecture and building construction, and the innovation in bridge and underground engineering.

This book forms the Proceedings of the International RILEM Workshop held in Paisley in March 1993. It contains contributions on theoretical and practical aspects of the use of special concretes, with a particular focus on their behaviour in the fresh state.

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 coming years.

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..

Practical production of ordinary and special, high performance concretes and their behaviour and properties when fresh are the main themes of this book. It derives from the International RILEM Conference held in Paisley, Scotland in June 1996, and represents the culmination of the work of two RILEM Technical Committees (145 WSM Workability of Special Mixes, and 150 ECM Efficiency of Concrete Mixers). Very significant advances have been made recently in the development of concrete with outstanding properties. Such advances in research must be matched by progress in the technology of concrete production. This book focuses on production methods and on workability and handling, two fundamental and closely linked stages of the concrete construction process. It has a strongly practical emphasis, with many contributions showing how to build effectively using the many high performance concretes which have progressed from research into construction in recent years. The main themes covered are: production mixers and mixing processes; production methods; sprayed and very dry precasting mixes; fibre reinforced concrete; flowing and superfluid mixes; rheology; test methods; mix design and models; special cements and concretes.

The FRC-2014 Workshop Fibre Reinforced Concrete: from Design to Structural Applications was the first ACI-fib joint technical event. The Workshop, held at Polytechnique Montreal (Canada) on July 24th and 25th 2014, was attended by 116 participants from 25 countries and 4 continents. The first international FRC workshop was held in Bergamo (Italy) in 2004. At that time, the lack of specific building codes and standards was identified as the main inhibitor to the application of this technology in engineering practice. Ten years after Bergamo, many of the objectives identified at that time have been achieved. The use of fibre reinforced concrete (FRC) for designing structural members in bending and shear has recently been addressed in the fib Model Code 2010. Steel fibre reinforced concrete (SFRC) has also been used structurally in several building and bridge projects in Europe and North-America. SFRC has been widely used in segmental tunnel linings all over the world. Members of ACI544 and fib TG-4.1 have been involved in writing code based specifications for the design of FRC structural members. More than fifty papers were presented at the Workshop from which forty-four were selected for this joint ACI/fib publication. The papers are organised in the document under six themes: Design guidelines and specifications, Material properties for design, Behaviour and design of beams and columns, Behaviour and design of slabs and other structures, Behaviour and design of foundations and underground components, and finally, Applications in structure and underground construction projects.

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).

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.

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.

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 report contains 27 papers that serve as a testament to the state-of-the-art of civil engineering at the outset of the 21st century, as well as to commemorate the ASCE's Sesquicentennial. Written by the leading practitioners, educators, and researchers of civil engineering, each of these peer-reviewed papers explores a particular aspect of civil engineering knowledge and practice. Each paper explores the development of a particular civil engineering specialty, including milestones and future barriers, constraints,

and opportunities. The papers celebrate the history, heritage, and accomplishments of the profession in all facets of practice, including construction facilities, special structures, engineering mechanics, surveying and mapping, irrigation and water quality, forensics, computing, materials, geotechnical engineering, hydraulic engineering, and transportation engineering. While each paper is unique, collectively they provide a snapshot of the profession while offering thoughtful predictions of likely developments in the years to come. Together the papers illuminate the mounting complexity facing civil engineering stemming from rapid growth in scientific knowledge, technological development, and human populations, especially in the last 50 years. An overarching theme is the need for systems-level approaches and consideration from undergraduate education through advanced engineering materials, processes, technologies, and design methods and tools. These papers speak to the need for civil engineers of all specialties to recognize and embrace the growing interconnectedness of the global infrastructure, economy, society, and the need to work for more sustainable, life-cycle-oriented solutions. While embracing the past and the present, the papers collected here clearly have an eye on the future needs of ASCE and the civil engineering profession.

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.

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.

Composite materials have aroused a great interest over the last few decades, as proven by the huge number of scientific papers and industrial progress. The increase in the use of composite structures in different engineering practices justify the present international meeting where researches from every part of the globe can share and discuss the recent advancements regarding the use of structural components within advanced applications such as buckling, vibrations, repair, reinforcements, concrete, composite laminated materials and more recent metamaterials. Studies about composite structures are truly multidisciplinary and the given contributions can help other researches and professional engineers in their own field. This Conference is suitable as a reference for engineers and scientists working in the professional field, in the industry and the academia and it gives the possibility to share recent advancements in different engineering practices to the outside world. This book aims to collect selected plenary and key-note lectures of this International Conference. For this reason, the establishment of this 20th edition of International Conference on Composite Structures has appeared appropriate to continue what has been begun during the previous editions. ICCS wants to be an occasion for many researchers from each part of the globe to meet and discuss about the recent advancements regarding the use of composite structures, sandwich panels, nanotechnology, bio-composites, delamination and fracture, experimental methods, manufacturing and other countless topics that have filled many sessions during this conference. As a proof of this event, which has taken place in Paris (France), selected plenary and key-note lectures have been collected in the present book.