Performance Of Polypropylene Fibre Reinforced Concrete

Concrete cracking, high permeability, and leaking joints allow for intrusion of harmful solutions, resulting in concrete deterioration and corrosion of reinforcement in structures. The development of durable, high-performance concretes with limited cracking is a potential solution for extending the service life of concrete structures. Further, the use of very early strength durable materials will facilitate rapid and effective repairs, reduce traffic interruptions, and decrease long-term maintenance work. The purpose of this study was to develop low-permeability durable materials that could achieve a very early compressive strength of 3,000 psi within 10 hours. Within the scope of this work, various proportions of silica fume and fly ash and steel and polypropylene fibers were used to evaluate crack control and post-cracking performance. Other characteristics including toughness, residual strength, water permeability of cracked concrete, and fiber distribution were also examined. The study showed that very early strength durable concretes can be achieved with proper attention to mixture components (amounts of portland cement and accelerating admixtures), proportions (water--cementitious materials ratio), and fresh concrete and curing temperatures. Fiber-reinforced concretes with steel fibers had considerably higher toughness and residual strength compared to concretes with polypropylene fibers. Permeability work showed that minor increases in crack width caused large increases in infiltration of solutions. Further, the addition of fibers can facilitate crack width control. An investigation of fiber distribution showed preferential alignment and some clumping of fibers in the specimens and highlighted the need for appropriate specimen size selection, sufficient mixing time, and proper sequencing of concrete ingredients into the

mixer for a uniform random fiber distribution. The results indicated that very early strength and durable fiber-reinforced concrete materials can be developed to improve the condition of existing and new structures and facilitate rapid, effective repairs and construction. The addition of fibers enables cracking control. Optimization of mixtures for strength and durability at different ages for specific applications is recommended.

Literature review, site condition surveys, and laboratory tests were conducted to assess the performance of asphalt concrete pavements reinforced by synthetic fibers (mainly polyester fibers and polypropylene fibers) in the present study. Based on available research reports, fiber reinforcement was found, in most instances, to be able to delay reflective crack formation in asphalt concrete pavements for up to two years. However, addition of fibers did not seem to significantly enhance the rutting resistance of fiberized sections.

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 use of fibrous materials in civil engineering, both as structural reinforcement and in non-structural applications such as geotextiles, is an important and interesting development. Fibrous and composite materials for civil engineering applications analyses the types and properties of fibrous textile and structures and their applications in reinforcement and civil engineering. Part one introduces different types of fibrous textiles and structures. Chapters cover the properties of natural and man-made fibres and of yarns, as well as an overview of textile structures. Part two focuses on fibrous material use in concrete reinforcement, with chapters on the properties and applications of steel fibre reinforced concrete, natural fibre

reinforced concrete and the role of fibre reinforcement in mitigating shrinkage cracks. In part three, the applications of fibrous material-based composites in civil engineering are covered. Chapters concentrate on production techniques and applications such as reinforcement of internal structures, structural health monitoring and textile materials in architectural membranes. With its distinguished editor and international team of contributors, Fibrous and composite materials for civil engineering applications is a standard reference for fabric and composite manufacturers, civil engineers and professionals, as well as academics with a research interest in this field. Explores the development of fibrous materials in civil engineering, both as structural reinforcement and in non-structural applications such as geotextiles Key topics include short fibre reinforced concrete, natural fibre reinforced concrete and high performance fibre reinforced cementitious composites A standard reference for fabric and composite manufacturers, civil engineers and professionals, as well as academics with a research interest in this field

Concrete is widely used because of its versatility, affordability, and availability of raw materials, strength, and durability. Urban development that took place through the world in the last few decades yielded significant developments for concrete technology. The term high-performance concrete (HPC) is relatively new, and it refers to many properties such as strength, durability, sound and heat insulation, waterproofing, and side advantages such as air purification, self-cleaning, etc. Researchers and engineers are constantly working for improving concrete properties. This book provides the state of the art on recent progress in the high-performance concrete applications written by researchers and experts of the field. The book should be useful to graduate students, researchers, and practicing engineers in related fields.

Advanced fibre-reinforced polymer (FRP) composites have become essential materials for the building of new structures and for the repair of existing infrastructure. Advanced fibre-reinforced polymer (FRP) composites for structural applications provides an overview of different advanced FRP composites and the use of these materials in a variety of application areas. Part one introduces materials used in the creation of advanced FRP composites including polyester, vinylester and epoxy resins. Part two goes on to explore the processing and fabrication of advanced FRP composites and includes chapters on prepreg processing and filament winding processes. Part three highlights properties of advanced FRP composites and explores how performance can be managed and tested. Applications of advanced FRP composites, including bridge engineering, pipe rehabilitation in the oil and gas industry and sustainable energy production, are discussed in part four. With its distinguished editor and international team of expert contributors, Advanced fibre-reinforced polymer (FRP) composites for structural applications is a technical resource for researchers and engineers using advanced FRP composites, as well as professionals requiring an understanding of the production and properties of advanced FRP composites, and academics interested in this field. Provides an overview of different advanced FRP composites and the use of these materials in a variety of application areas Introduces materials used in the creation of advanced FRP composites including polyester, vinylester and epoxy resins Explores the processing and fabrication of advanced FRP composites and includes chapters on prepreg processing and filament winding processes

The main motivation for this work was the attempt to limit the rapid destruction of brittle high performance concrete UPC and, in consequence, to obtain SRCC (safe rope effect cement

composite). In the high performance fiber reinforced cement composites HPFRC deflection and flexural strength are increased. The rope effect in HPFRC results in a highly deflected damaged specimen with multicracking effect and with post-peak load at bending exceeding that corresponding to the first crack, which enables to obtain cement composite with the ability to absorb additional energy after the appearance of the macrocrack. The SRCC paste and mortar were presented in the previous paper. This paper shows different effects of the strengthening of cement concrete with dispersed synthetic structural polypropylene fibers 19 and 54mm long. The possibility to control multicracking and the crack propagation process using the rope effect for SRCC composites, which eliminates the catastrophic process of the destruction of composite, was presented and a new possibility of the strengthening effects assessment was suggested.

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

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).

Advanced cementitious composites can be designed to have outstanding combinations of strength (five to ten times that of conventional concrete) and energy absorption capacity (up to 1000 times that of plain concrete). This second edition brings together in one volume the latest research developments in this rapidly expanding area. The book is split into two parts. The first part is concerned with the mechanics of fibre reinforced brittle matrices and the implications for cementitious systems. In the second part the authors describe the various types of fibre-cement composites, discussing production processes, mechanical and physical properties, durability and applications. Two new chapters have been added, covering fibre specification and structural applications. Fibre Reinforced Cementitious Composites will be of great interest to practitioners involved in modern concrete technology and will also be of use to academics, researchers and graduate students.

Determined to evaluate compatibility of the earthen mortar with the fiber-reinforced CEBs. There was a general improvement in flexural performance and ductility of the fiber-reinforced matrices as evidenced by the load-deflection behavior, equivalent flexural strength, residual strength, and flexural toughness. Relationships between fiber quantity and enhancements in tested mechanical properties were observed and predictive models for compressive strength and equivalent flexural strength proposed. An observation of fractured surfaces after flexural strength testing using scanning electron microscopy (SEM) showed both fiber fracture and pullout; an indication of good fiber-matrix bonding. The earthen mortar was deemed compatible

with the fiber-reinforced CEBs based on prism compressive strength, flexural bond strength, and failure mode. The results of this research show that when carefully designed and produced, polypropylene fiber-reinforced CEBs can be used to construct CEB masonry with improved ductility, deformability, and flexural performance.

"In the research project presented in this PhD-thesis, an innovative type of fibre concrete is developed, with improved both the tensile strength and the ductility: the Hybrid-Fibre Concrete (HFC). The expression "Hybrid" refers to the "hybridisation" of fibres: short and long steel fibres were combined together in one concrete mixture. This is opposite to conventional steel fibre concretes, which contain only one type of fibre. The basic goal of combining short and long fibres is from one side to improve the tensile strength by the action of short fibres, and from the other side to improve the ductility by the action of long fibres." "In this research project, all important aspects needed for the development and application of Hybrid-Fibre Concrete have been considered. In total 15 mixtures, with different types and amounts of steel fibres were developed and tested in the fresh state (workability) as well as in the hardened state (uniaxial tensile tests, flexural tests, pullout tests of single fibres and compressive tests). A new analytical model for bridging of cracks by fibres was developed and successfully implemented for tensile softening response of HFC. At the end, the utilisation of HFC in the engineering practice was discussed, including a case-study on light prestressed long-span beams made of HFC."--BOOK JACKET.

The thesis presents the results of an experimental investigation of the performance characteristics of concrete members reinforced with basalt fiber reinforced polymer (BFRP) bars along with polypropylene fibers. The primary objective of the research is

the identification of the stress-strain relationship which ensues the determination of the load-strain behavior and maximum load capacity of the basalt FRP reinforced slabs reinforced with or without polypropylene fiber. The slab tests were designed to determine the influence of concrete strength and percentage volume of fiber on the maximum load capacity, shear strength, deflections and ductility. One of the objectives of the slab tests is also the study of the load-deflection behavior of the basalt FRP reinforced beams with and without polypropylene fiber. Another objective of the research is to check the validity of the code defined design methods for the calculation of shear strength for FRP reinforced beams made from fiber reinforced concrete. The secondary objective of this research was to study the effect of polypropylene fiber on the post-cracking strengths of beams and round determinate panels and to find the correlation between the beam and panel specimens. To achieve the objectives of this study, large number of plain and fiber reinforced concrete slab elements, and cylinders were cast with two different fiber dosages (1.0% and 0.5% volume fraction). The type of fiber used was Ferro (2.25"). All the slabs were tested under four-point bending to determine the maximum load capacity of slabs. Six fiber reinforced concrete beams and two round panels with 0.5% volume fraction of fiber were cast to determine the average residual strength (ARS) and toughness properties respectively. The standard test methods ASTM C1399 was used for testing the beams and ASTM C1550 was used for testing the round panels. The cylinder compression tests revealed that compressive

strength decreased marginally with the increase in fiber dosage. The load carrying capacity of the slabs particularly in shear strength mode is found to increase with the addition of polypropylene fiber to the concrete in spite of the lower concrete strength. The concrete compressive strains and the tensile bar strains were found to increase with the addition of fiber. The deflections were decreased with the addition of fiber to the concrete. For the polypropylene fiber reinforced concrete slabs, an average of 8% difference was observed in the predicted values of maximum load obtained using the proposed model, an average of 9% difference using the Desayi and Krishnan curve for plain concrete, an average of 8% difference using the Hognestad's Model and an average of 20% difference using the ACI 440.1R method with failure loads being greater than the predicted strengths. For the slabs without polypropylene fiber, an average of 16% difference was observed in the predicted values of maximum load obtained using Desayi and Krishnan curve and an average of 18% difference was observed using Hognestad's Model and 12% difference using the ACI method with predicted strengths being much greater than the corresponding failure loads obtained from tests. The theoretical deflections determined using the ACI 400.1R method was reasonably close to the experimental deflections obtained from tests. A need for the improvement of shear strength equations given by ACI 440.1R is determined based on the comparison of experimental shear strength to the shear strength equation given by ACI 440.1R. The amount of energy stored in concrete with respect to that stored in

BFRP bars is determined using the Proposed method and Hognestad's model. The evaluations show that in spite of the lower concrete strengths of the polypropylene fiber-reinforced concrete slabs compared to the plain slabs, the percentage of energy stored in concrete for the polypropylene-fiber reinforced concrete slabs is found almost more or less equal to the percentage of energy stored in concrete for the slabs without fiber. For the ductility of the slabs, the ducitility index is found to decrease with increasing reinforcement ratio. With the addition of polypropylene fiber to the slabs, the ductility of the slabs was found to be less than that for the slabs without fiber due to the lower concrete strength of the polypropylene fiber-reinforced concrete slabs. For the study of post-cracking strength, five beams and two round panels were tested. From the beam tests, the average residual strength of the polypropylene fiber reinforced concrete beams were found to be greater than the average residual strength of the beam observed from literature. From the round panel tests, the toughness of the polypropylene fiber reinforced concrete panels was found to be greater than toughness of the panels observed from the published literature. From these tests, the correlation between the flexural toughness of beam and panel specimens was also studied and compared with the published literature. It was found that the linear correlation suggested in literature for other types of fiber is equally valid for polypropylene fiber.
This volume presents the proceedings of the symposia organized under the umbrella of Celebrating concrete: People and practice, an international meeting organized by the

University of Dundee"s Concrete Technology Unit. CONTENTS include: Mechanical Properties for Concrete; Role of Fibers in Ductility and Strength; Durability and Performance; Withstanding Severe Conditions; Specialist Concrete and Construction Techniques; and Exploiting Concrete.

This book summarizes and simplifies the results of a considerable body of research and practical experience with a wide range of fiber-reinforced cementitious composites.

This book presents the select proceedings of the International Conference on Civil Engineering Trends and Challenges for Sustainability (CTCS 2020). The chapters discuss emerging and latest research and advances in sustainability in different areas of civil engineering, which aim to provide solutions to sustainable development. The contents are broadly divided into the following categories: construction technology and building materials, structural engineering, transportation and geotechnical engineering, environmental and water resources engineering, and RS-GIS applications. This book will be of potential interest to beginners, researchers, and professionals working in the area of sustainable civil engineering and related fields.

Concrete made using mineral cements, the raw materials which on earth are practically endless, is known as one of the oldest building materials and during the last decades of the twentieth century has become a dominant building material for general use. At the same time, the requirements of the quality of concrete and its performance properties, in particular compressive strength, durability, economical efficiency, and low negative

impact of its manufacture on the environment have not yet been completely met. Bearing these requirements in mind, researchers and engineers worldwide are working on how to satisfy these requirements. This book has been written by researchers and experts in the field and provides the state of the art on recent progress achieved on the properties of concrete, including concrete in which industrial by-products are utilized. The book is dedicated to graduate students, researchers, and practicing engineers in related fields.

Provides a thorough review of properties, durability and use of high performance concrete, derived from recent research and experience. This book contains contributions from the leading French, Canadian and Swiss researchers, designers and material specialists, translated into English for the first time.

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

This book comprises selected papers from the International Conference on Civil Engineering Trends and Challenges for Sustainability (CTCS) 2019. The book presents latest research in several areas of civil engineering such as construction

and structural engineering, geotechnical engineering, environmental engineering and sustainability, and geographical information systems. With a special emphasis on sustainable development, the book covers case studies and addresses key challenges in sustainability. The scope of the contents makes the book useful for students, researchers, and professionals interested in sustainable practices in civil engineering.

Saint-Gobain/Vetrotex developed a new fiber known as "FibraShield" for potential application to fiber reinforced concrete. There was need to evaluate the performance of this new fiber and compare its performance with other fibers in order to launch it for commercial use. This thesis summarized the results of the experimental investigation conducted to evaluate the performance of the newly developed high tenacity monofilament polypropylene fiber "FibraShield" manufactured in three different lengths 0.5 inch (12.5mm), .075 inch (18mm) and 1.5 inch (38mm) when added to concrete at different dosage levels ranging from 0.33 to 5.0 lbs/yd3 (0.196 to 2.965 kg/m3). The performance evaluation includes a study of the influence of addition of FibraShield fiber on the properties of both fresh and hardened concrete. To achieve these objectives, ASTM and other standard tests were performed in the Rama Materials Laboratory of the South Dakota School of Mines and Technology. Fresh concrete tests included slump

test, air content test, temperature of freshly mixed concrete, and plastic shrinkage tests. Hardened concrete tests included compressive strength, flexural strength, splitting tensile strength, bond strength, impact strength, average residual strength test and resistance to rapid freezing and thawing of concrete. The results of this investigation show that the workability and finishability characteristics were improved as long as the slump loss was not severe. There was insignificant increase in the air content of fresh concrete when fiber was added. The FibraShield fiber of 0.75 inch (18mm) length performed better than the shorter fiber of 0.5 inch (12.5mm) length in terms of plastic shrinkage crack reduction. There was no change in the compressive strengths of concrete as long as the air content was relatively unchanged. With increased fiber dosage, the increase in the flexural and splitting tensile strengths was observed. The impact strength increased considerably with the addition of fiber. The ultimate (maximum) bond stress was also increased with addition of FibraShield fibers. Higher dosages of fibers did not increase bond strength proportionately because of inadequate distribution of fibers. Overall, there was increase in the average residual strength when fibers were added to concrete. There was a significant increase in the freeze-thaw durability due to addition of FibraShield fibers to non-air entrained concrete.

Over the last forty years I have been lucky enough to have experienced a unique career researching and developing composite materials, in both industry and academia, during a time of unprecedented expansion in the global composites business. Over that time, I have been involved in areas as diverse as the development of new and novel fibre and composite products through to fundamental materials research. My research efforts have been focussed in three main areas; the fibre-matrix interface region, fibre reinforcements and in particular glass fibres, and the structure-(re)processing-performance relationships of reinforced thermoplastics. The published output of that work is collected together in this series of volumes. The 23 papers collected in this volume summarise my more than thirty year journey through the research and development of fibre reinforced polypropylene. Of all the materials that I have worked on, PP based composites have been my favourite where all three areas of my research expertise had to be brought into play. The story starts with fundamental research to better understand the phenomenon of the transcrystallised interphase in fibre reinforced PP. It then moves on to structure-processing-performance of PP composites with emphasis on the development of long fibre technology. This includes the influence of fibre length, concentration, and diameter, and the use of glass and natural fibre as a PP reinforcement.

Finally, throughout most of this collection, there is a continual focus on the characterisation and nature of adhesion of PP to fibres.

This paper describes the materials used, mixture proportions, mixing and shotcreting operation, and properties of the fresh and hardened polypropylene fiber-reinforced shotcrete incorporating silica fume and high volumes of fly ash. The polypropylene fiber-reinforced high-volume fly ash shotcrete produced had satisfactory workability, mechanical properties, and resistance to freezing and thawing cycling. The shotcrete containing silica fume had negligible rebound compared with that without silica fume. The incorporation of fly ash and silica fume improved the workability of the fresh shotcrete, and this resulted in lower operating pressure for the shotcreting. The use of polypropylene fibers up to 0.5% by the volume of the shotcrete did not affect significantly the compressive strength, and the shotcrete incorporating both fly ash and silica fume bonded well to the base concrete. The fiber-reinforced shotcrete showed satisfactory performance after 300 cycles of freezing and thawing with a durability factor >80 even though the air contents were relatively low, and the spacing factor L ? was relatively high.

Portland cement concrete is a brittle material. The main reason for incorporating fibres into a cement matrix is to improve the cracking deformation characteristics,

increasing not only the toughness, impact and tensile strength, but also eliminating temperature and shrinkage cracks. Several different types of fibres have been used to reinforce cement-based materials. This chapter briefly discusses the characteristics of fibre-reinforced concrete (FRC), reporting the effect of the fibres on the physico-chemical and mechanical properties. It also presents some of the recent research and future perspectives of FRC.

Performance of Polypropylene Fibre Reinforced Concrete in the State of QatarPerformance of Advanced Polypropylene Fibre Reinforced ConcreteSustainability Trends and Challenges in Civil EngineeringSelect Proceedings of CTCS 2020Springer Nature

This book outlines a methodology for producing macro recycled polypropylene (PP) fibres with optimal mechanical properties and illustrates the reinforcing effects of recycled PP fibres in concrete. It describes the great potential of using these fibres in concrete applications such as footpaths and precast elements. Further, it sheds new light on the environmental impacts of using recycled PP fibres, which are evaluated by means of cradle to gate life cycle assessment based on the Australian context. The use of recycled PP fibre not only helps reduce consumption of virgin materials like steel or plastic but also provides an attractive avenue for recycling plastic waste. The book will appeal to engineers, governments, and solid waste planners, and offers a valuable reference for the plastic waste recycling and plastic fibre reinforced concrete industries. /div

Synthetic fibers have been recently used as a replacement for conventional steel reinforcement in concrete pipes to enhance their durability, ductility, shear strength, and

flexural strength. However, there is very limited understanding of the long-term performance of thin-wall synthetic fiber-reinforced concrete pipes, as synthetic fiber has material properties that may change with a sustained load over time. This research investigates the performance of polypropylene fiber-reinforced concrete pipe under short and long-term loads in terms of strength, deflection response, strain response, crack width, and crack patterns. Concrete pipes with diameters of 1,200 and 1,500 mm with respective wall thicknesses of 50 and 63 mm were subjected to the short-term three-edge bearing test. To ensure maximum fiber contribution to pipe strength, a 9 kg/m 3 fiber dosage was used with different amounts of steel reinforcement. For the long-term three-edge bearing test, a pipe with a diameter of 1,200 mm reinforced with fiber dosage of 9 kg/m 3 along with steel reinforcement with an area of 5.7 cm 2 /m was tested for 30 days at 40 % of the ultimate load (Load Stage 1) obtained from the short-term test, for another 30 days at 50 % ultimate load (Load Stage 2), and subsequently at 70 % ultimate load for a final 30 days (Load Stage 3). Short-term results showed that synthetic fiber was a viable replacement for the steel reinforcement cage, as some of the tested pipe achieved the strength requirement specified by ASTM C76-15a, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe . In response to sustained load, the tested pipe initially exhibited a linear response, followed by a stable response with a slight increase in deflection over time. Fiber creep did not significantly increase the crack width or affect the time dependence of the strain, indicating that the fibers adequately transfer the stress in the pipe wall and limit the crack width. The cracks propagated longitudinally at the invert, crown, and springline, where there were high flexural tensile stresses.

Lignocellulosic Fibre and Biomass-Based Composite Materials reviews the development,

characterization and applications of composite materials developed from the effective use of lignocellulosic fibre and biomass. The book gathers together a wide spectrum of cutting-edge research on biomass fillers and reinforcements used for the fabrication and synthesis of composites. The book takes a systematic approach, investigating processing, design, characterization and applications of biocomposites, in order to establish their important relationship as a general guideline for end-user applications. Beginning with an introduction to biomass and its composites, a team of leading experts in the field cover rice husk, kenaf, oil palm, alfa and doum fibres, bamboo, cork, and many other materials, considering a range of applications, along with key issues such as performance and sustainability. The groundbreaking research presented opens the door to obtaining advanced material characteristics and significant enhancements in physical, mechanical, and thermal properties. This will be become an extremely useful reference and technical guide for academic and industrial researchers in composite materials, as well as for advanced students and industrialists working in material commercialization. Gathers together a wide spectrum of research on lignocellulosic fiber and biomass fillers and reinforcements used for the fabrication and synthesis of composites Presents multidisciplinary work in relation to materials engineering, polymer chemistry and physics, materials processing, organic synthesis and industrial design and applications Demonstrates systematic approaches and investigations from processing, design, characterization and applications of biocomposites

This Special Issue on “Cement-Based Composites: Advancements in Development and Characterization” presents the latest research and advances in the field of cement-based composites. This Special Issue covers a variety of experimental studies related to fiber-

reinforced, photocatalytic, lightweight, and sustainable cement-based composites. Moreover, simulation studies are presented in this Special Issue to provide fundamental knowledge of designing and optimizing the properties of cementitious composites. The presented publications in this Special Issue show the most recent technology in the cement-based composite field.